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FEASIBILITY OF USING S-191 INFRARED SPECTRA FOR GEOLOGICAL STUDIES FROM SPACE

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16. Abstract

Use of the S-191 spectrometer system aboard the SKYLAB SL3 mission showed that geologically-meaningful spectra can be extracted from the data by which terrain target can be differentiated. The Si-O bond in all silicates (which form most surface rocks) produced an emission minimum which is characteristic of a mineral, or a set of minerals in a rock. The underflight RB57 mission was far more successful, primarily because of its much slower velocity allowing a higher signal/noise, and hence better spectral resolution for any given area of terrain. With the RB57 spectra not only could areas be differentiated, but significant differences in rock targets could be demonstrated, even to indicating the immediate source (geological provenance) of some alluvial outwash in the nearby mountains over which the aircraft also flew its flight strip.

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PREFACE

Objective

To demonstrate that differentiation between geologically-significant materials could be made from high altitudes (RB57), and that comparable data could be extracted from space flight, using the pointing and tracking capability of the S-191 spectrometer system. Inherent in this design is a pair of data sets—a RB57 underpass with the Infrared Pallet (spectrometer and radiometer) and a closely concurrent SKYLAB-S-191 overpass. This was achieved on August 11, 1973, in SL3 overpass along Track 6—Walker Lake, Nevada, and Mission 248 RB57 flights.

In the aircraft experiment the technique used involved ratioing the target spectra (+ airmass) to those of a lake (+ airmass), nearby. This method had proved successful in previous geological studies with the same instrumentation at lower altitudes (MX108 Pisgah Crater, California, at 700 m (2000 ft)) (Lyon, 1972).

Scope of the Work

The S-191 experiment was to explore the possibility of securing terrain spectra despite the increased airpath (20 km to 320 km; 65,000 ft to 200 mi) of the SKYLAB vehicle, and thereby including the effects of the ozone layer (9.6 μm absorption band) usually located around 36 km (120,000 ft) altitudes. This would be attempted by using the unique pointing ability of the S-191 system, with astronaut control, to locate and hold a water target (Walker Lake, for example) while tracking from a 45 degree forward view, to local vertical, thereby affecting some degree of atmospheric calibration from the changing airpath during the tracking motion (airmass $m = 1.41$ to $m = 1$). In addition SKYLAB would be moving at 34,760 km/hr (6 mi/sec) and the RB57 about 570 km/hr.

Conclusions

1. Time checks between the airborne data sets of the RB57 underflight and the photographic record could be obtained, if the times-of-crossing of shorelines of water bodies are initially correlated. Similar validation was possible with the SKYLAB data sets, although some confusing boresight

photography (at high zoom position) often indicated water on the cross hairs, while the S-191 data temperatures indicated warmer land surfaces.

2. The RB57 (vertical viewing) spectrometry can be related meaningfully to ground geology, despite the 20 km of air, if care is taken to use large patches of terrain as targets, and to expect some (small) amount of positional error.

The unrequested summing of spectra from the rapid scanning spectrometer (6 scans/sec; 3 up ramp and 3 down ramp, interleaved) to 1 scan/sec up ramp and 1 scan/sec down ramp tripled the ground-smear per spectrum and destroyed some of the spectral subtlety usually in the data sets. In no way was it possible to directly compare S-191 and RB57 data sets, because of their different mission profiles (azimuths, times of overflight, look angles, etc.) thus the commonality of the 1 sec spectrum was of no assistance.

3. The S-191 was a feasibility test and as such performed well. It is possible to differentiate geological materials from space using the system, but probably not to precisely identify their surface mineralogy. (With the RB57 the rock type mineralogy could be established, albeit in terms broad to a traditional petrographer.)

Summary of Recommendations

1. Direct-reading spectra, from S-191 data, serially on a single tape would avoid the time-consuming (and dollar cost) of running two tapes at once, and searching within them for the six sections required to be joined into one spectrum. A more complex format could not be believed.

2. In future missions, use of the S-191 concept (δ+ near-vertical viewing and pointing) is all that would be necessary. The possible refinement in atmospheric subtraction, using a variable view approach (-45 deg to near-vertical) does not appear to warrant the allocation of mission time it required. Water observations, as nearly coincident as possible with the terrain observations, are an essential part of the method.

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1. INTRODUCTION

On several occasions it has been established that rock materials (silicates) in open-terrain surfaces, under ambient (sunlit) conditions, will show mid-infrared spectra by which they can be differentiated, whether the materials be close by, or distanct, and whether the spectrometer be stationary, or airborne at low altitudes (Lyon, 1963, 1970, 1972; Lyon and Marshall, 1971; Lyon and Patterson, 1966; Lyon and Green, 1975).

This experiment was aimed at extending the altitudes (air path effects) to those of a high altitude aircraft (RB57, at 20 km) and thence to SKYLAB, in orbit at 320 km, passing over the targets at 34760 km/hr (6 mi/sec) using the pointing abilities of the astronaut-S-191 spectrometer combination.

Two test sites were used--Mono Lake and Walker Lake in western central Nevada, to provide blackbody ($\varepsilon = 0.98$) targets with which to compare the terrain emittance spectra, and hence obtain emissivity spectra. With SKYLAB the astronaut was to acquire the lake at a 45 deg forward view and trace the lake center until it passed by the nadir. This airpath change ($m = 1.41$ to $m = 1$) was to effect some atmospheric corrections. The field of view was then to be moved forward to track-and-hold a geological target until enough spectra could be obtained for calculation of emissivity ($N > 5$).

2. DATA BASE AVAILABLE: SL3, day 223, 11 August 1973

2.1 General Weather/Atmospheric Conditions for Overpass

Reno: Barometer 14:00 GMT (0700 PDT) 3009 mbar
Wind--calm visibility unlimited
Haze zero

Weather was superb, with a clarity and stillness of the air column unusual even for western Nevada. Smoke columns rose vertically in excess of 1 km and in a light plane at 500 to 700 m/terrain a complete absence of air turbulence, even near the Sierran crest, was striking; the pilot especially remarked upon the quiet air.

a. A single RB57 flight with IR-pallet instrumentation (spectrometer, radiometer, boresight camera) was secured on the same morning as the Track 6 pass (day 223) of SKYLAB-3, 11 August 1973. Spectrometer time-on-target at the northwestern end of the 100 km flight line was 16:24:43.1 hrs GMT;

time-off at the southeastern end was 16:35:15.8 hrs GMT (averaging about 570 km/hr). Walker Lake was passed over between 16:29:20 and 16:30:13.5 GMT. SKYLAB passed almost vertically over Walker Lake 1 hr earlier at 15:27:16 GMT after acquiring it at 45 deg forward view at 15:26:12 and left it behind at 15:27:19 GMT the same morning (see fig. 2.2 for flight line of MX248).

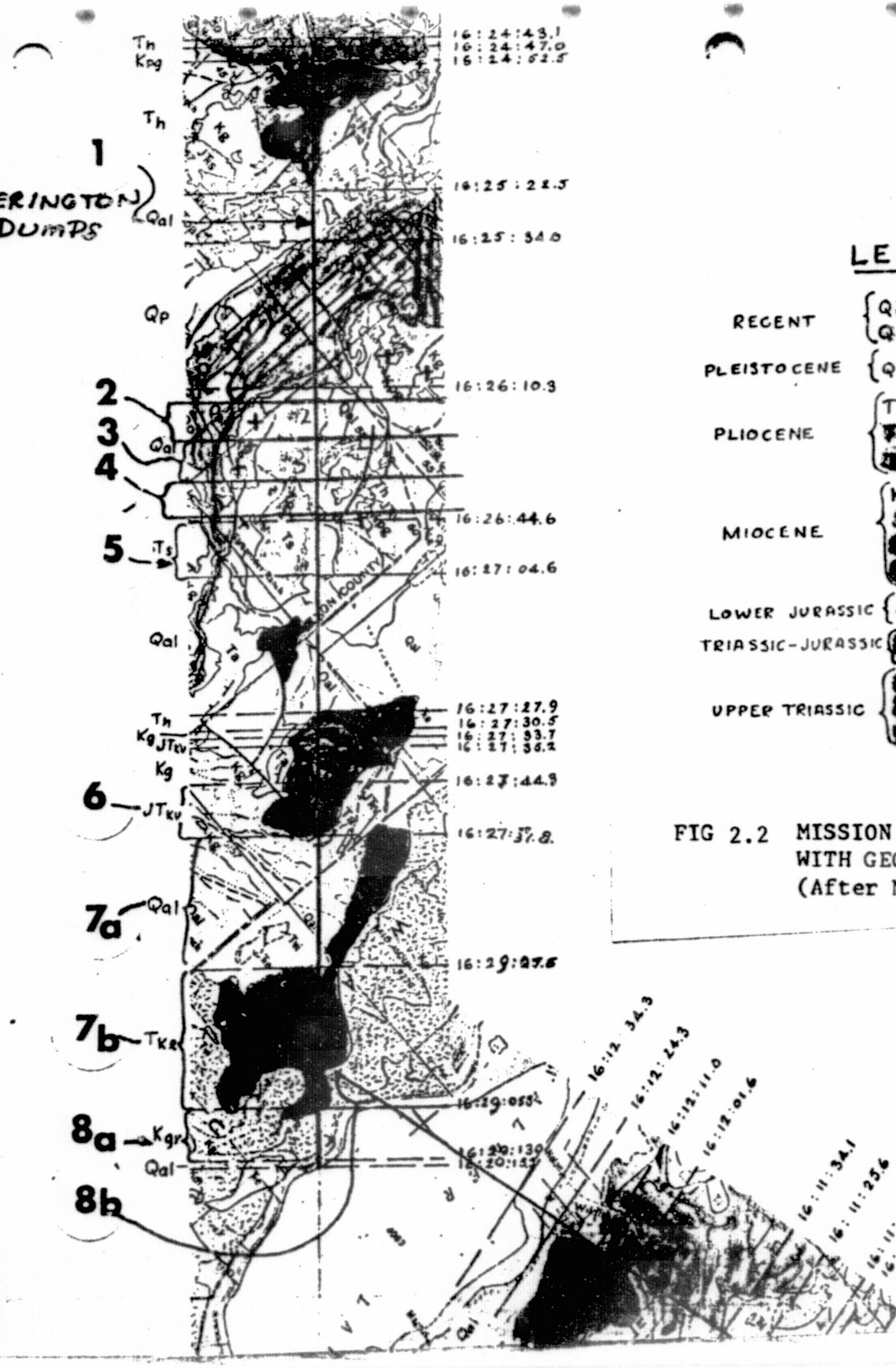
b. RB57, IR pallet data are complete for the 10.5 min data pass over the Yerington-Walker Lake-Garfield Flat flight line. Other slightly earlier data on the Gabbs Playa-Walker Lake (E-W) line did not match the footprint of the SKYLAB data and were not used for direct comparisons.

c. RB57 radiometer data indicate a water temperature of 20.17 ± 0.29°C (N = 24) for Walker Lake around 16:12:45.0 for the initial western pass (Gabbs Playa-to-Walker Lake), and 21.14 ± 0.32°C (N = 54) around 16:29:43.0 on the longer NW-SW pass. Concurrent RB57 spectrometer data indicated a lake temperature of 22 °C at 16:12 and 22.4°C, N = 22 (maximum at 10.7 μm) at 16:29:40-16:30:00 over South Walker Lake. If water is considered as a blackbody (ε = 0.98) the relative bandpasses of each unit need not be considered. Light aircraft flights at 300 m above the lake, using a PRT-5 and visual recording of temperatures, showed 23.8 ± 0.7°C, N = 20 for around 15:30 and 23.2 ± 0.5°C, N = 6 for around 17:00 GMT while covering much of the total lake surface. A boat using digital thermometers and a PRT-4 radiometer showed 23.3 ± 0.4°C between 15:05 and 16:15 while moving SE along the anticipated RB57 flight line.

d. Over the dry playa lake (Garfield Flat) the RB57 radiometer indicate 30.9 ± 0.35°C (N = 5) while the RB57 spectrometer data showed 33.3°C (maximum at 12.17 μm) N = 6, both from 16:33:48 to 16:33:53 GMT, pointing out the lowered average emittance of the playa surface. Spectrally the playa shows an emittance minimum centered at 9.6 μm, outside the bandpass of the radiometer (10.375-12.1 μm).

2.2 Low Altitude Aircraft and Boat Coverage

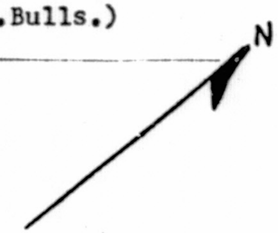
Two "ground control" operations were scheduled in coincidence with the anticipated SL3 overpass, and temperatures taken of Walker Lake during that time. It was also hoped that the RB57 underflight could be "calibrated" but the exact time for <u>its</u> flights were not known in advance.



LEGEND

RECENT	Qal	ALLUVIAL DEPOSIT (VALLEY FILL)
	Qpl	ALLUVIAL DEPOSIT (CLAY AND PLAYA)
PLEISTOCENE	QTm	MAFIC VOLCANIC ROCKS
PLIOCENE	Ts	SEDIMENTARY ROCKS
		FELSIC VOLCANIC ROCKS
		INTERMEDIATE VOLCANIC ROCKS
MIOCENE	Kgr	GRANITIC ROCKS
	Kpg	PORPHYRITIC QUARTZ MONZONITE
		NON-PORPHYRITIC QUARTZ MONZONITE
		HARTFORD HILL RHYOLITE TUFF
LOWER JURASSIC	Jd	DUNLAP FORMATION (SS, CGl, VOL)
TRIASSIC-JURASSIC		METAVOLCANIC ROCKS
UPPER TRIASSIC		GABBS AND SUNRISE FORMATION (SH, LS)
		LUNING FORMATION (LS, DOL, SH)
		EXCELSIOR FORMATION (INT. TO FEL. VOL.)

FIG 2.2 MISSION 248 GROUND TRACK (RB57)
WITH GEOLOGICAL TRAVERSE MAPS
(After Nev.Geol.Surv.Bulls.)



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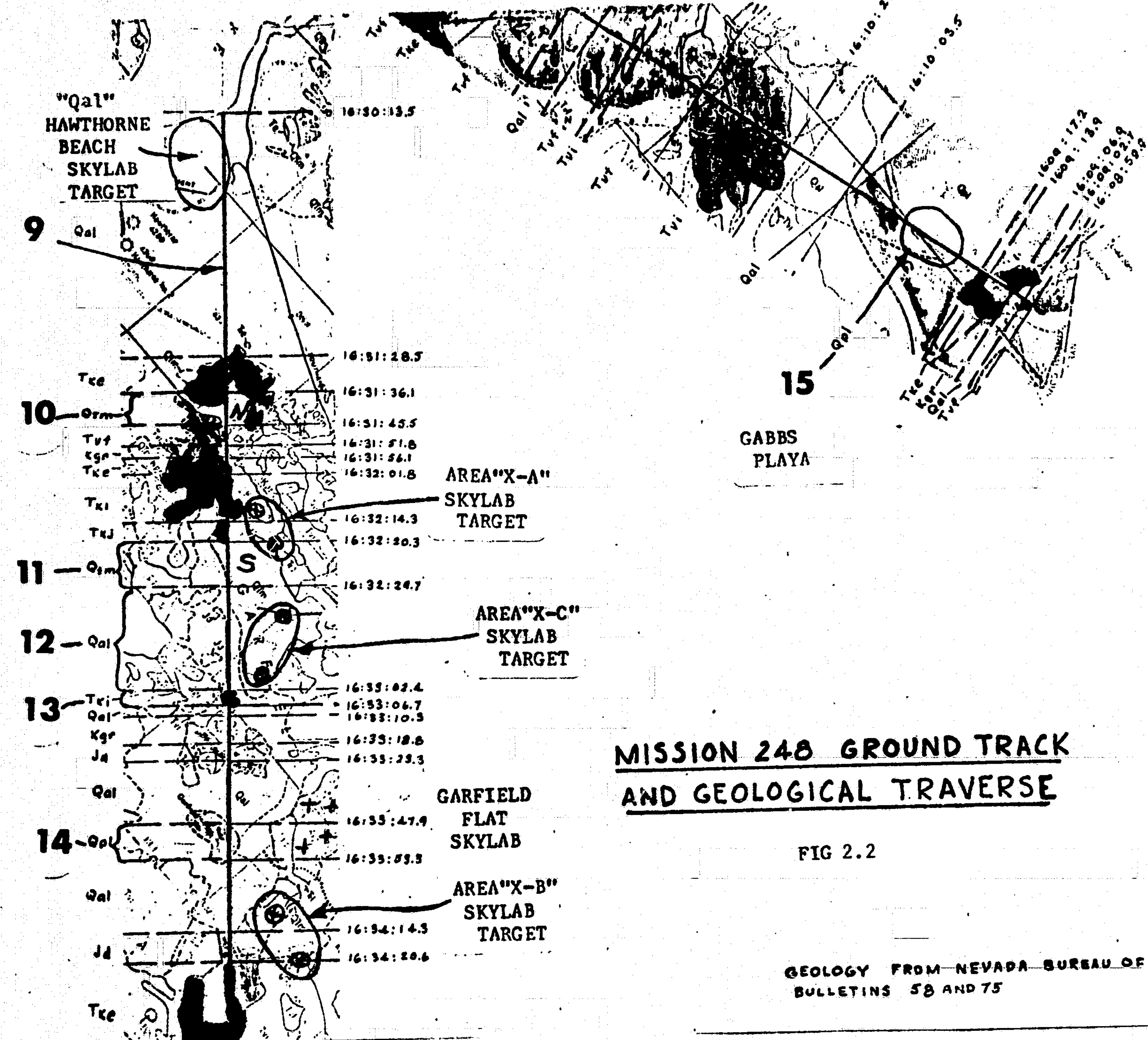

MISSION 248 GROUND TRACK AND GEOLOGICAL TRAVERSE

FIG 2.2

GEOLOGY FROM NEVADA BUREAU OF MINES BULLETINS 58 AND 75

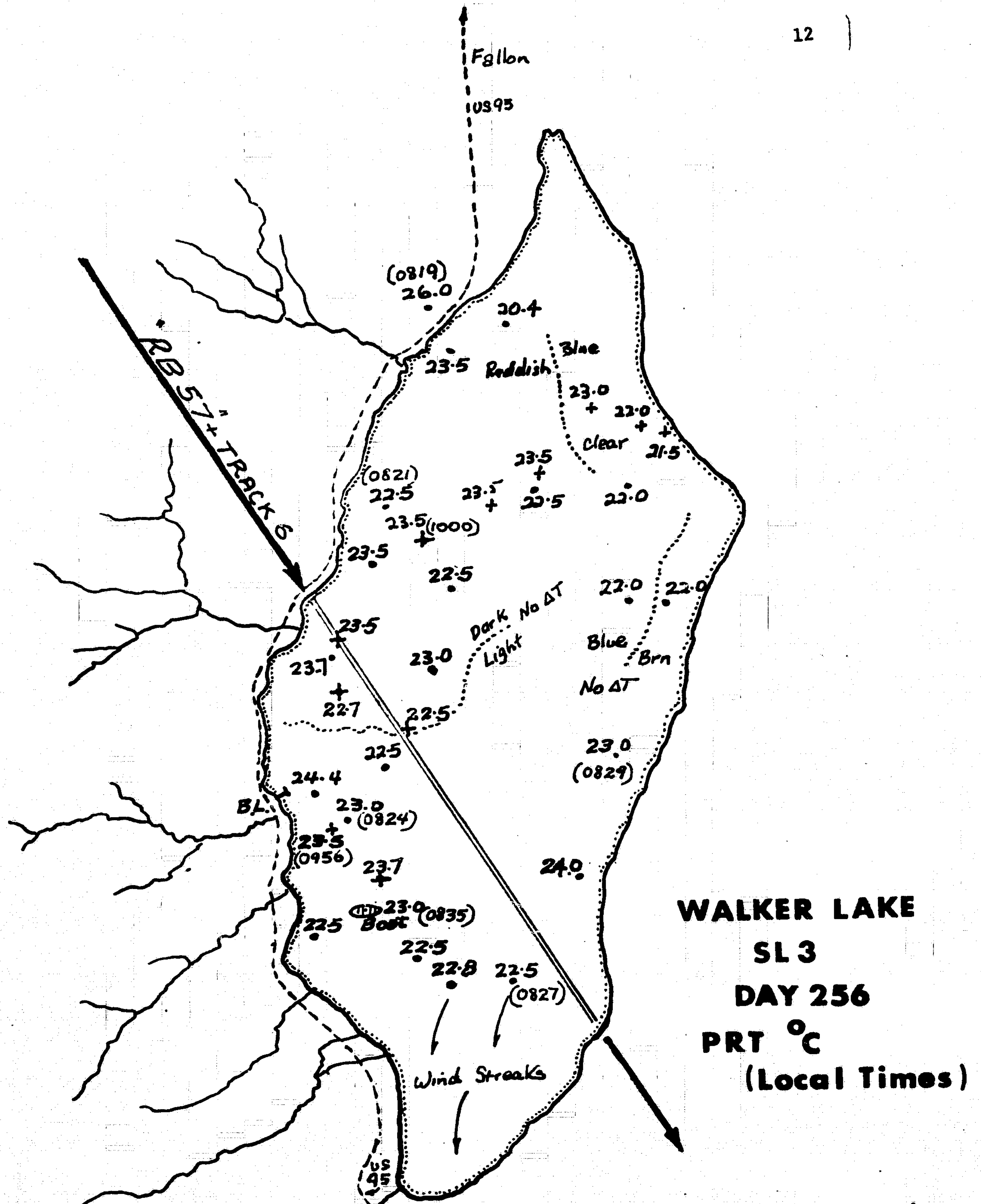

Figure 2.2.1 Walker Lake SL 3
Day 256

Table 2.2

Summary of Available Data on Temperatures, Etc.
(using RB57 pallet units, light aircraft, boats)

	Radiometer with ±1 σ	Spectrometer (σ not calc.)		Ground water record
Walker Lake				
16:12:45 (N lake)	20.17±0.29°C (N = 24)	22	23.1°C at 16:25	no data
16:29:43 (S lake)	21.14±0.32 (N = 54)	22.4 (N = 22)		23.3°C at 16:15
Garfield Flat				
16:33:48-16:33:53	30.9±0.35 (N = 5)	33.3 (N = 6)	A/C on ground, no data at 16:30 (see table 2.2)	30.5°C at 16:30

			Comments
Granitic rocks--Kgr			
Kgr 2 16:13:11-16:13:20	31.23±2.0 (N = 10)	34 (N = 10)	V. low emittance
Kgr 1 16:29:6-16:29:11	32.25±2.5 (N = 6)	36 (N = 5)	V. low emittance
Yerington Dump			
16:25:22.5-16:25:34	28.65±2.9 (N = 13)	29 (N = 3)	Medium
Mafic Volcanic Rocks			
(N) 16:31:40-16:31:45	31.40±3.3 (N = 6)	37 (N = 5)	High
(S) 16:32:22-16:32:30	30.46±1.9 (N = 8)	33 (N = 8)	High emittance
Alluvium Qal			
Qal:NL 16:30:41-16:30:49	32.5 ± 0.5 (N = 9)	35 (N = 9)	V. low emittance

Table 2.2 (cont'd.)

Qal-1 16:26:13-16:26:23	32.3 ± 0.2 (N = 11)	35 (N = 11)	Medium
Qal-2 16:26:23-16:26:33	31.7 ± 0.5 (N = 10)	34 (N = 11)	Medium
Qal-3 16:26:33-16:26:43	31.5 ± 0.5 (N = 11)	34 (N = 11)	Medium
Qal "low temp" 16:28:11-16:28:20	26.4 ± 0.5 (N = 10)	29 (N = 10)	Medium

2.2.1 Aircraft Data at 300 m

A light plane (Cessna 201) was rented from Reno airport and the PRT-5 precision radiation thermometer used (by the PI), from 300 m, pointing it outside the right hand window vertically downwards to the terrain (or lake) surface, while manually recording the temperature, averaged over 10 sec. Locations and temperatures were plotted directly onto a 1:120,000 (U2) black and white set of air photos which contained the expected SL3 ground track. Figure 2.2.1 shows the plots of the lake temperatures, open circles for the first NW-to-SE flight between 15:20:00 (GMT) and 15:35 and closed circles for the second SE-to-NW passes between 16:55 and 17:05. Temperature data for Garfield playa and adjoining alluvial were also taken from 300 m (table 2.2). We landed on Garfield playa between 16:20 and 16:40 to confer with J. Quade, University of Nevada Remote Sensing group who was taking ISCO spectrometer and PRT-4 radiometer temperatures during the same morning period of the SL3 overflight (table 2.2). Our light plane can be seen on the playa surface in the high resolution CIR films (30.48 cm, or 12 in. lens RC8) taken from the RB57 as it passed over us at 16:38:48.

Table 2.2.1

Comparison of Radiometers at Garfield Playa
at 16:30 GMT
(Univ. Nevada data, gratefully received from J. Quade)

Stanford PRT-5 (as used in the lake overflight)	30.5°C
Univ. Nevada PRT-4	30.8°C
RB57 radiometer (16:33:48-16:33:52)	30.9 ± 0.35, N = 5
RB57 spectrometer (16:33:48-16:33:53)	33.3 max at 12.17 μm

The necessary temperature data appear on figure 2.2.1. The total set appears in Appendix B.

2.2.2 Lake Surface Data (boat) Coverage

Concurrently Gary Ballew was in a small boat with outboard engine on a traverse NW-to-SE from the landing at Smiths Boat Docks, central west shore of Walker Lake. His thermometer and radiometer data (PRT-4) appear in table 2.3.

Table 2.2.2

Walker Lake Surface Temperatures

Time GMT	Digital thermometer °C	PRT-4 radiometer °C
15:05	23.3	22.8
15:10	23.9	23.3
15:30	23.6	23.3
15:37	23.3	22.8
15:45	23.9	23.3
15:58	24.7 S end	23.9 S end
16:05	23.9 returning N	23.3
16:15	23.9	23.3

RB57 at 20 km elevation above S end Walker Lake 16:29:40-16:30:00; N = 22

Pallet radiometer 21.1°C

Pallet spectrometer 22.4 (max at 10.7 µm)

2.3 RB57 High Altitude Flight at 20 km

2.3.1 Cameras (RB57)

RC8; 15.24 cm (6 in.) lens--color film (23 cm)

RC8; 30.48 cm (12 in.) lens--color infrared film (23 cm)

Hasselblad (6) 15.24 cm (6 in.) lens--black and white film (70 mm)

Pallet boresight; 15.24 cm (6 in.) lens--color (35 mm)

Only the RC8 color film and the boresight films were needed for the data analysis, for location purpose. The 70 mm films were used to produce the locality photos for test sites (figs. 3.1.3, A-D).

2.3.2 Infrared Pallet (RB57)

The infrared pallet equipment is believed to be the same as flown on the P3A aircraft in MX108, in 1970. Table 2.3.2 is taken (from Lyon

Table 2.3.2

Infrared Pallet (RB57)
(from Lyon and Marshall, 1971)

Airborne Rapid Scan Spectrometer	
Scan wavelength	6.76-13.30 μm with 100 elements per spectrum. The CVF[a] wheel has 2 similar spectral octaves—one from 0° to 180°, and one from 180° to 360°
Scan period	0.150 s (6 spectra/s)
Field of view	0.4 degree square (7 mrad)
Detector	Hg-doped germanium, time constant less than 1 μs, cooled by liquid helium
Essential output signals (four)	a) spectral radiance output (analog) b) wavelength ramp (analog, not presently used) c) wavelength (peripheral-edge coding) pulses, every 2°, or 90 per spectrum, 180 per rotation of the CVF (see table 11) d) a spike pulse, (at 0°) was used to fire the boresight camera (used for location purposes)
Accuracy required	10-bit, i.e., better than 0.1 percent
Infrared Radiometer	
Filter bandpass; sampling frequency	10.374 to 12.1 μm approximately 60 temperature measurements per second, i.e., ten to every spectrum (or 1 every 9 spectral elements)
Field of view	0.4 degree, circular (7 mrad)
Detector	Hg-doped germanium, time constant less than 1 μs, liquid helium cooled
Essential output signals (one)	radiance signal sampled 60 times/s (analog)
Accuracy required	10 bit, i.e., better than 0.1 percent
Boresight Camera	
Type	35-mm framing camera, with film-recorded clock and frame counter, electrically pulsed by output command from spectrometer (at approximate rate 3 s)
Field of view	approximately 5° to yield telescopic view of the target. Camera pulse originates 5 ms before the no. 1 data pulse, i.e., just past the 0° position

[a]CVF: circular variable filter, a circular dispersive element.

and Marshall, 1971) to be the listing of the equipment as flown. No communication to the contrary was received, although two fundamental differences appeared in the data sets when read off the MX248 tapes, namely,

1. Three spectra, originally taken at 6/sec (i.e., 3 "up-ramp" and 3 "down-ramp" interleaved), had been added together to make one spectrum/sec, each "up-ramp" and "down-ramp." Apparently this was done to make them more comparable with the 1/sec S-191 spectra. At no time was this requested by this Principal Investigator, or was he informed until many months after the fact.

2. The wavelength-versus-counter pulse tables, provided to the Principal Investigator late in 1973 did not match that provided in 1971. No explanation was presented, so we have adopted the new ones (see tables 2.3.3 and 2.3.4) believing them to be correct.

The field of view of the Pallet Spectrometer was 0.4° square (or 7 mrad). At 20 km (65,000 ft) this would cover 140 m (460 ft). The <u>total "footprint" of 1 spectrum per second</u> (1973 data style) would be 140 m wide by 166 m in length (460 x 546 ft), using a ground speed of 600/km/hr (324 kts) for the RB57. (Remember, using only up-ramp data there are two missing sets of down-ramp data in this length. It is not easy to use both up-ramp <u>and</u> down-ramp data as the wavelength intercepts for comparable counter-pulses are not similar, nor are the filterwheel transmission levels the same.)

2.4 SKYLAB Coverage at 442 km

2.4.1 SL2: Mono Lake—Track 29

The S-191 experiment was attempted during a Track 29 pass to the north of Mono Lake, California (Prime Target No. 1), on day 156 from 19:22:45 to 19:23:52 GMT. Several problems in the S-191 unit precluded adequate data analysis, but the most significant was that the sun glint off Mono Lake effectively observed the island target. (This can be very easily seen if the S-191 boresight film--16 mm--is played in a standard movie projector as a time-lapse, movie sequence.)

Our field crew monitored the South Shore site at Mono Lake with field support from J. Quade, University of Nevada. The effort was confused

Table 2.3.3

Counter Pulse-Versus-Wavelength for Pallet Spectrometer

N	L(N)
93	6.66
94	6.70
95	6.78
96	6.84
97	6.92
98	6.98
99	7.07
100	7.12
101	7.21
102	7.27
103	7.35
104	7.42
105	7.49
106	7.55
107	7.62
108	7.70
109	7.78
110	7.84
111	7.92
112	7.99
113	8.06
114	8.13
115	8.21
116	8.29
117	8.36
118	8.44
119	8.52
120	8.59
121	8.67
122	8.75
123	8.83
124	8.96
125	8.98
126	9.06
127	9.13
128	9.22
129	9.28
130	9.37
131	9.44
132	9.51
133	9.60
134	9.67
135	9.77
136	9.83
137	9.91
138	9.98
139	10.06
140	10.13
141	10.21
142	10.29
143	10.37
144	10.44
145	10.50
146	10.58
147	10.65
148	10.73
149	10.80
150	10.88
151	10.97
152	11.03
153	11.11
154	11.18
155	11.25
156	11.33
157	11.40
158	11.48
159	11.53
160	11.61
161	11.66
162	11.75
163	11.81
164	11.88
165	11.96
166	12.03
167	12.10
168	12.17
169	12.24
170	12.30
171	12.38
172	12.45
173	12.52
174	12.59
175	12.64
176	12.72
177	12.79
178	12.85
179	12.92
180	13.00

Pallet spectra extend only from 6.66 to 13.0 µm.

N = pulse #

L(N) = wavelength (µm)

Table 2.3.4

Counter Pulse-Versus-Wavelength for S-191 Spectrometer

N	L(N)	N	L(N)	N	L(N)
115	6.00	156	10.10	197	14.05
116	6.10	157	10.20	198	14.10
117	6.20	158	10.30	199	14.15
118	6.30	159	10.40	200	14.20
119	6.40	160	10.50	201	14.25
120	6.50	161	10.60	202	14.30
121	6.60	162	10.70	203	14.35
122	6.70	163	10.80	204	14.40
123	6.80	164	10.90	205	14.45
124	6.90	165	11.00	206	14.50
125	7.00	166	11.10	207	14.55
126	7.10	167	11.20	208	14.60
127	7.20	168	11.30	209	14.65
128	7.30	169	11.40	210	14.70
129	7.40	170	11.50	211	14.75
130	7.50	171	11.60	212	14.80
131	7.60	172	11.70	213	14.90
132	7.70	173	11.80	214	15.00
133	7.80	174	11.90	215	15.10
134	7.90	175	12.00	216	15.20
135	8.00	176	12.10	217	15.30
136	8.10	177	12.20	218	15.40
137	8.20	178	12.30		
138	8.30	179	12.40		
139	8.40	180	12.50		
140	8.50	181	12.60		
141	8.60	182	12.70		
142	8.70	183	12.80		
143	8.80	184	12.90		
144	8.90	185	13.00		
145	9.00	186	13.10		
146	9.10	187	13.20		
147	9.20	188	13.30		
148	9.30	189	13.40		
149	9.40	190	13.50		
150	9.50	191	13.60		
151	9.60	192	13.70		
152	9.70	193	13.80		
153	9.80	194	13.90		
154	9.90	195	13.95		
155	10.00	196	14.00		

Note: Spectra extend from 6.00 to 15.40 µm.

N = pulse #

L(N) = wavelength (µm)

by frequent change in Prime Target (from Mono Lake to Walker Lake), associated with the many orbit problems of SL2.

2.4.2 SL3: Walker Lake--Track 6

Walker Lake was our No. 2 Prime Target and was selected for coverage on a Track 6 (NW to SE) pass on day 223, 11 August 1973 from 15:26:12 GMT and passing off Garfield Flat geological target at 15:27:35.

This day we also had a RB57 infrared pallet flight which we had requested as a part of the total experiment. In addition we used a light plane to gather lake water temperatures, as well as a boat which proceeded directly along the anticipated SL3 track from a midpoint on the western shore, towards the SE shore. J. Quade was stationed at Garfield Flat, a playa 42 km SE directly along the projected SL3 track, taking surface temperatures and ISCO spectrometer measurements.

Because of this coverage we have selected this day (day 223) for our data analysis.

2.4.3 SL3: Mono Lake (and Walker Lake)--Track 29

Although no RB57 underflight was scheduled the S-191 experiment was tried on a Track 29 (SW to NE) pass over central California (Fresno) to central north Nevada (Austin). We received enough advance warning to get the field crew into place, again using the light plane-PRT-5 radiometer set-up for airborne coverage of Mono Lake supported with measurements taken from a small boat along the South Shore site at Mono Lake.

Mono Lake was acquired at 45° forward view at 19:31:42 GMT on day 256 and water was tracked only until 19:31:47 when Paoha Island near acquired, although still at 45° forward view. The island was held until 19:32:41 or 11° and then water intersected again. The SL3 crew then noticed Target 2 (Walker Lake) and swept the S-191 field of view northeast to track-and-hold that lake. Unfortunately this made the analysis very difficult because of insufficient evidence time on either target. Actually it was the absence of the RB57 underflight, though, which decided for us that we should not attempt any analysis of that track--at least until we could fully interpret the principal Track 6 pass along Walker Lake. No further analysis has been made therefore of any Mono Lake data. (Figure 2.4.3)

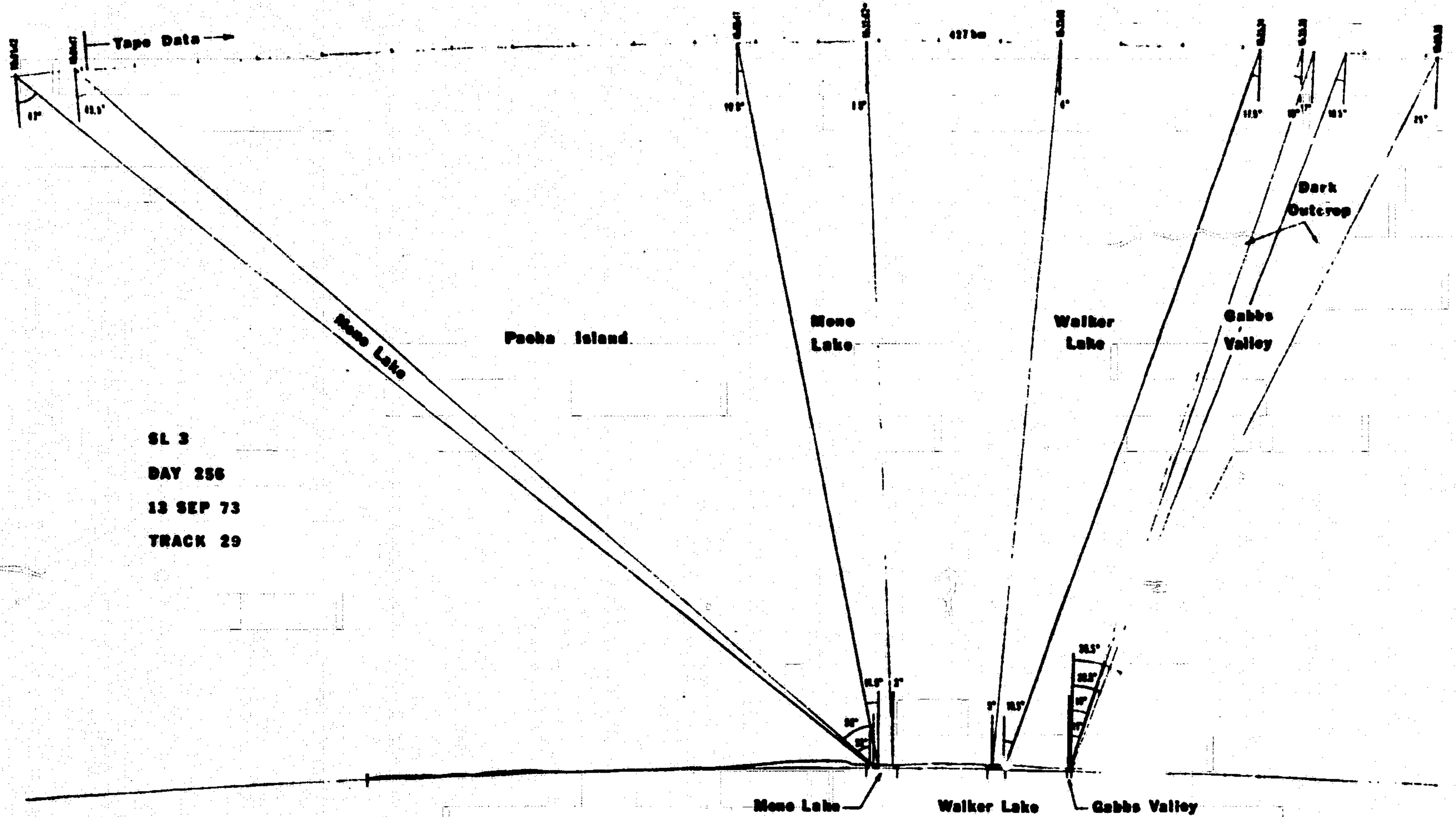

Figure 2.4.3 Profile for SL3, day 256, 13 September 1973, Track 29

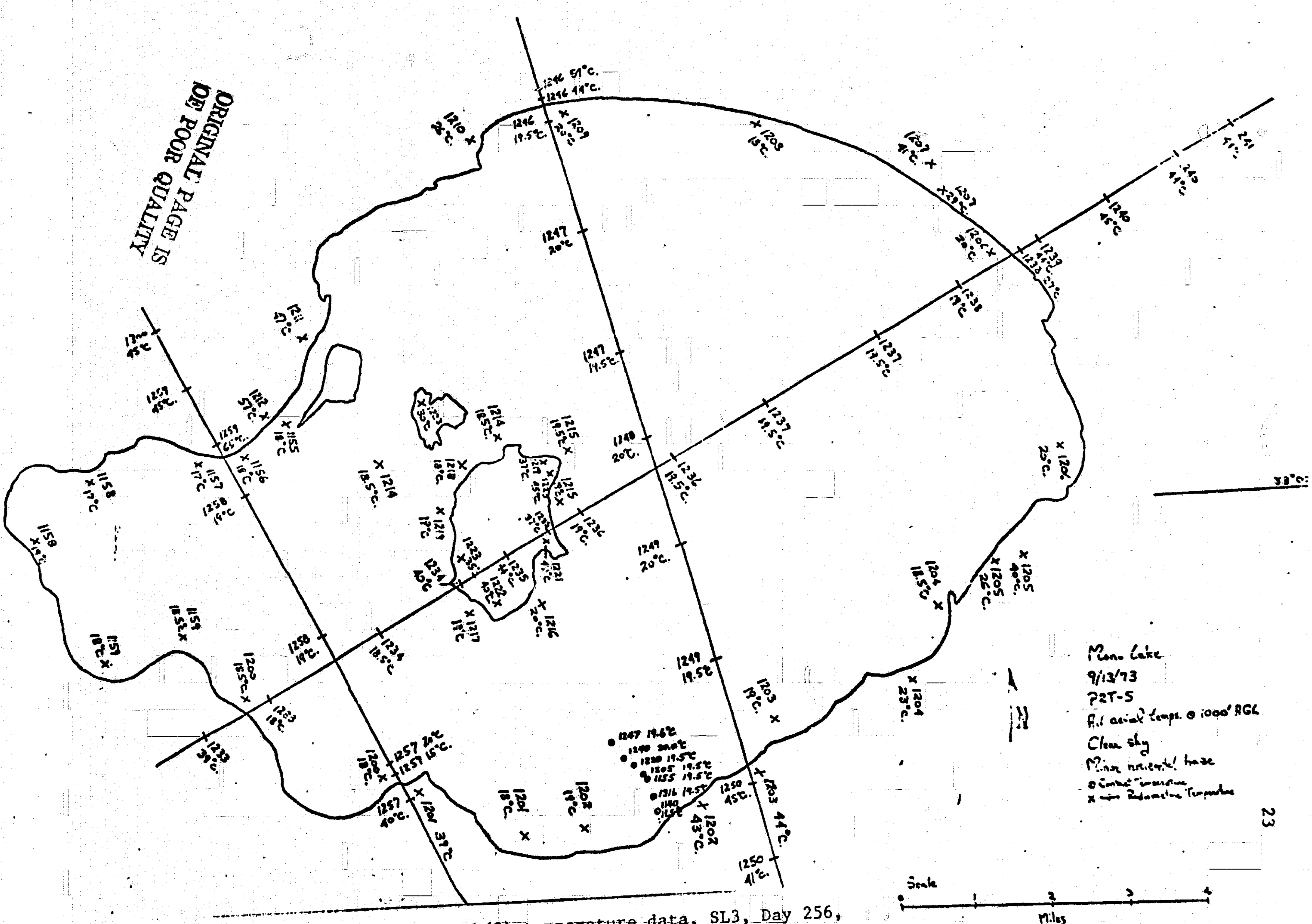

Figure 2.4.4 Airborne (+) and Shipboard (0) temperature data, SL3, Day 256, Sept 13, 1973--Mono Lake

Figure 2.4.4 shows the airborne (light aircraft with PRT-5) and waterborne (ship) data taken at Mono Lake, day 256, 13 September 1973. All aerial data are at 300 m altitude above the lake, in a clear sky with slight horizontal haze.

3. GROUND LOCATION OF SPECTRAL DATA

Both the S-191 spectrometer and the RB57 IR pallet instruments (spectrometer and radiometer) are non-imaging, hence they must be provided with boresighted camera systems to indicate the passage of their fields of view across the terrain. With the pallet system this is accomplished by using a boresighted 35 mm instrumentation camera, which takes a frame every two spectra (2 x 151 msec), or roughly 3/sec. This camera has a 15.24 cm (6 in.) focal length matching that of the RC8 with mapping cameras also carried by the RB57. Image matching thus is a relatively easy (although time consuming) manual process.

The S-191 spectrometer had a boresighted 16 mm recording (DAC) camera incorporated into the tracking optics, and also noted roll pitch and yaw of the optical axis digitally on the film margins.

The criticality of relating the radiometer and spectrometer data to the surficial materials and geology required a careful and painstaking determination of the precise ground location at the time the data were acquired. The core of this determination is based on the recorded time of the boresight cameras, the images recorded at that time and the knowledge that some misalignment could exist between the alignment of the boresight camera with the radiometer and spectrometer in the Mission 248 aircraft, and the S-191 DAC camera.

3.1 RB57 Pallet

3.1.1 RC8 Cameras/Boresight Timing

Timing is therefore the only common denominator between pallet instruments. However, at least five times can exist in the data sets, although one hopes that their only difference is an offset delta-time (table 3.1.1).

As a first step we carefully inspected the pallet radiometer records for rapid changes in temperature (shorelines of Walker Lake, ridge crests (sunlit or shadowed in the early morning--local standard time 0700).

Table 3.1.1

Aircraft Times and Associated Problem

(a)	RC8 camera pulse time	Camera has three rotating shutters, and noted time in the logs may not have any relation to precise shutter closure.
(b)	Boresight pulse time	May be shutter (pulse output) or spectrometer output signal.
(c)	ADAS time	Carried in code on each RC8 frame.
(d)	Boresight camera time	Carried in digits on each B/S frame.
(e)	RB57 master clock	May or may not be GMT. Most likely the time on the magnetic tapes.

These data breaks should be easily identifiable both in the radiometer and spectrometer data, as well as clearly seen in the RC8 and boresight camera data. No dramatic changes in times were noted, and the analysis proceeded.

3.1.2 Location of Test Sites on the Data Records

The recorded time (Type 4) and location of every tenth frame of the boresight camera was transferred to the RC8 frame and used to minimize the distortion. This procedure located the ground track of the aircraft and related it to RC8 (Type 1) time. Usually the ground track is a straight line, but it may curved in regions of rapid relief change, or during roll or pitch motion of the aircraft.

Once it was established that no marked delta-times exist, the flight line of the aircraft could be correlated, from the RC8 frames to the basic geologic and/or topographic maps. The time that formation boundaries were crossed were then calculated using aircraft ground speed, and time from known geographical control points such as the shores of Walker Lake; the time of crossing of which is recorded on the boresight camera images. These times are also recorded on the radiometer temperature trace along the line of flight (See figs. 3.1.2 A to P.) which served as a vital data set for <u>all subsequent</u> spectral analysis. It was possible to identify

MISSION 248 (IR RADIOMETER DATA)

RADIOMETER TEMPERATURE

XMIN= 19,000, XMAX= 37,000, DELTA= .150

TIME	RAD TEMP
161 8: 20,501	29,798
161 8: 21,497	30,812
161 8: 22,493	30,613
161 8: 23,489	30,239
161 8: 24,484	30,327
161 8: 25,480	30,135
161 8: 26,476	30,001
161 8: 27,472	30,477
161 8: 28,467	30,600
161 8: 29,463	30,320
161 8: 30,459	30,283
161 8: 31,455	30,319
161 8: 32,451	30,121
161 8: 33,446	29,699
161 8: 34,442	29,509
161 8: 35,438	29,653
161 8: 36,434	29.722
161 8: 37,430	29,663
161 8: 38,425	29,542
161 8: 39,421	29,151
161 8: 40,417	29,380
161 8: 41,413	29,790
161 8: 42,408	29,765
161 8: 43,404	29,739
161 8: 44,400	29,808
161 8: 45,396	29,768
161 8: 46,392	29,412
161 8: 47,387	29,467
161 8: 48,383	29,297
161 8: 49,379	28,993
161 8: 50,375	28,760
161 8: 51,371	29,473
161 8: 52,366	29,352
161 8: 53,362	30.120
161 8: 54,358	30,553
161 8: 55,354	31,036
161 8: 56,349	30,998
161 8: 57,345	31,008
161 8: 58,341	31,524
161 8: 59,337	29,985
161 9: ,333	30,156
161 9: 1,329	31,821
161 9: 2,324	28,355
161 9: 3,320	27,906
161 9: 4,316	26,015
161 9: 5,312	26,866
161 9: 6,307	29,115
161 9: 7,303	29,782
161 9: 8,299	29,968
161 9: 9,295	30,329
161 9: 10,291	30,584
161 9: 11,287	31,878
161 9: 12,282	31.308
161 9: 13,278	28,858
161 9: 14,274	25,590
161 9: 15,270	24,243
161 9: 16,266	24,488

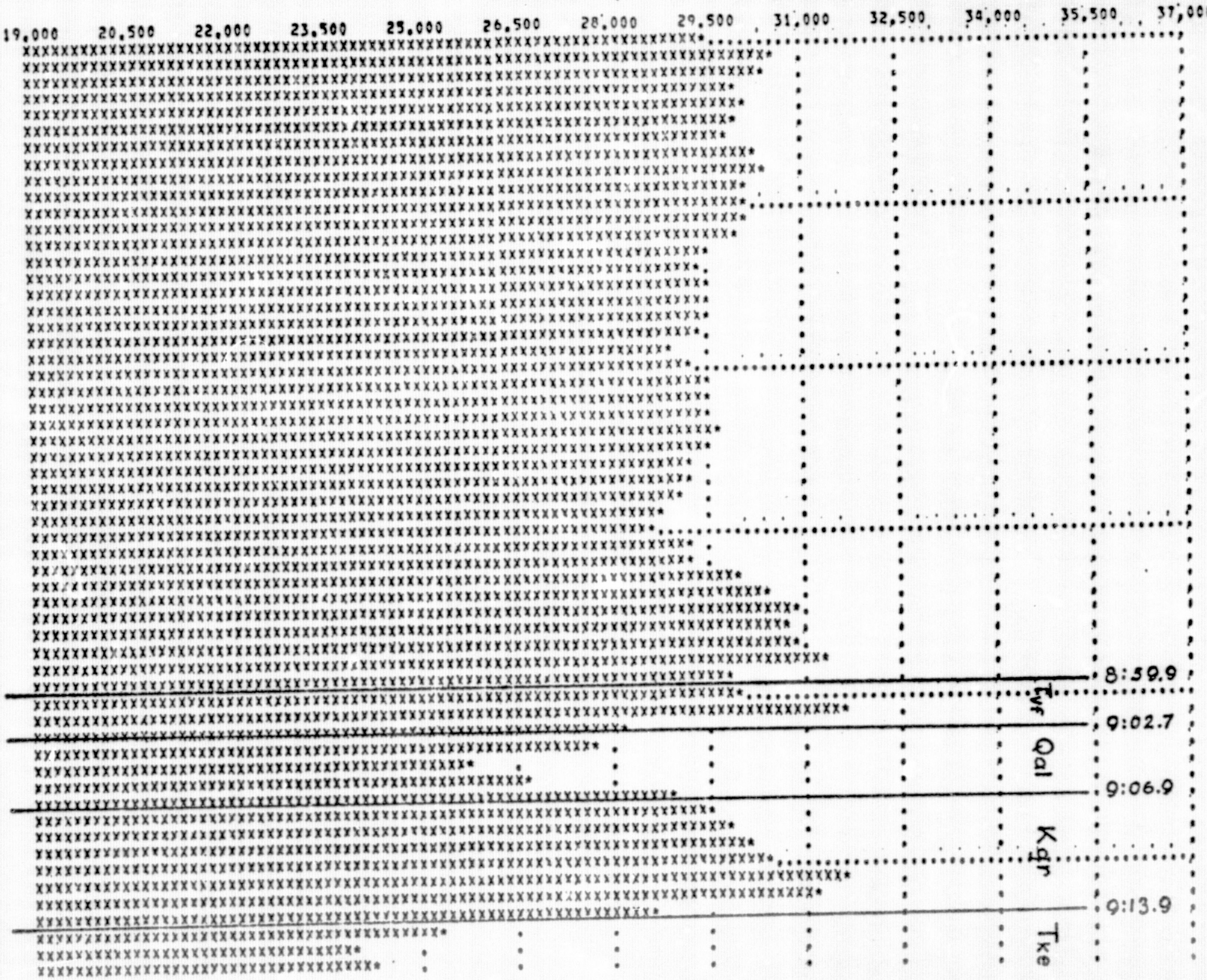

Figure 3.2.1 (A-P) Profile for SL3, Day 223, 11 August 1973, Track 6

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16: 9: 23,236	27,261
16: 9: 24,232	26,911
16: 9: 25,228	26,688
16: 9: 26,224	26,921
16: 9: 27,220	26,523
16: 9: 28,215	26,522
16: 9: 29,211	26,442
16: 9: 30,207	26,330
16: 9: 31,203	26,292
16: 9: 32,199	26,382
16: 9: 33,195	26,136
16: 9: 34,190	25,863
16: 9: 35,187	25,748
16: 9: 36,182	26,022
16: 9: 37,178	25,887
16: 9: 38,174	25,880
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16: 9: 41,161	25,968
16: 9: 42,157	25,823
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16: 9: 44,149	26,359
16: 9: 45,144	26,549
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16: 9: 47,136	26,876
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16: 9: 49,128	27,748
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16: 9: 51,119	28,668
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16: 9: 53,111	29,075
16: 9: 54,107	29,260
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16: 9: 57,095	27,785
16: 9: 58,090	27,932
16: 9: 59,086	28,325
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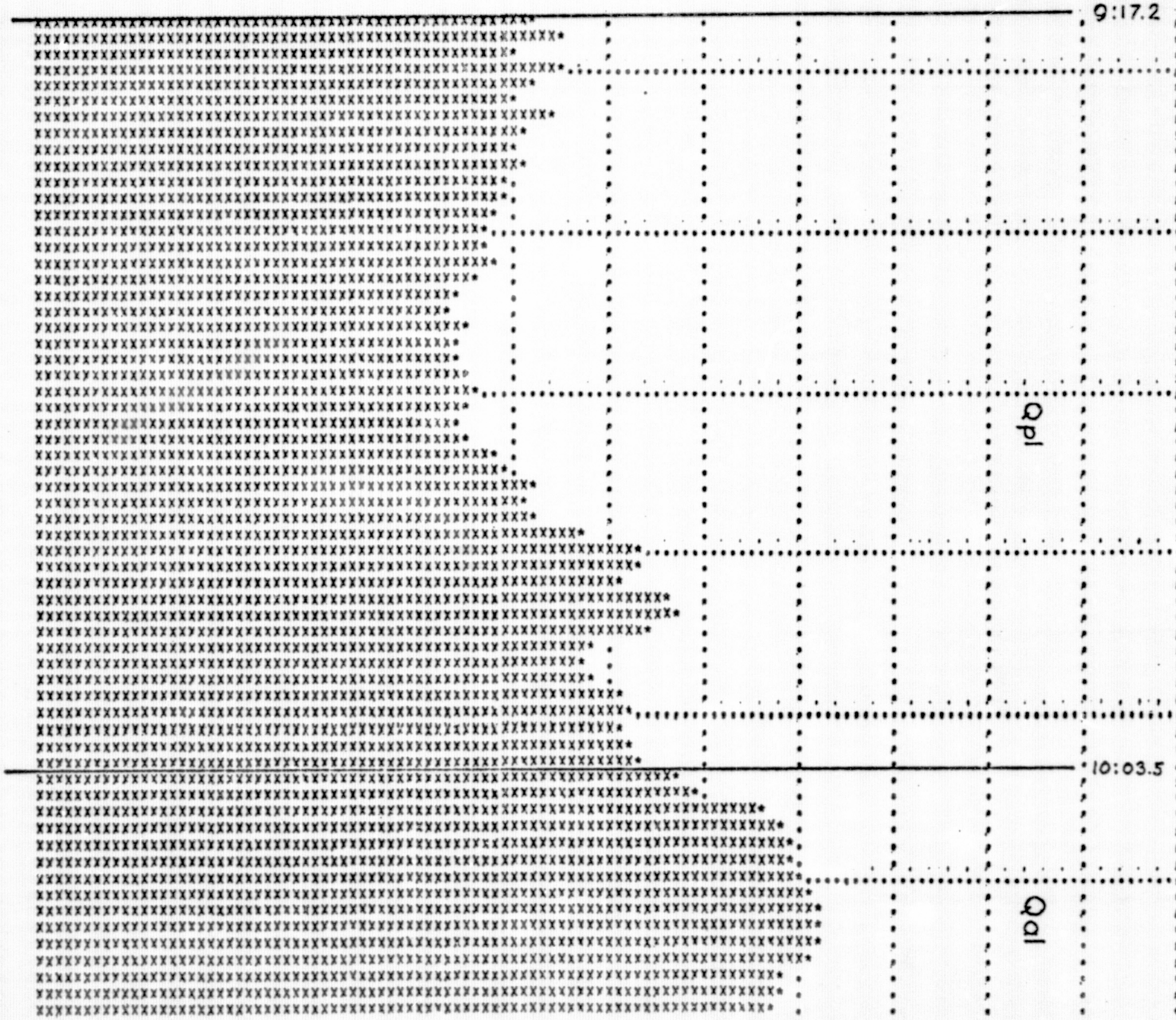

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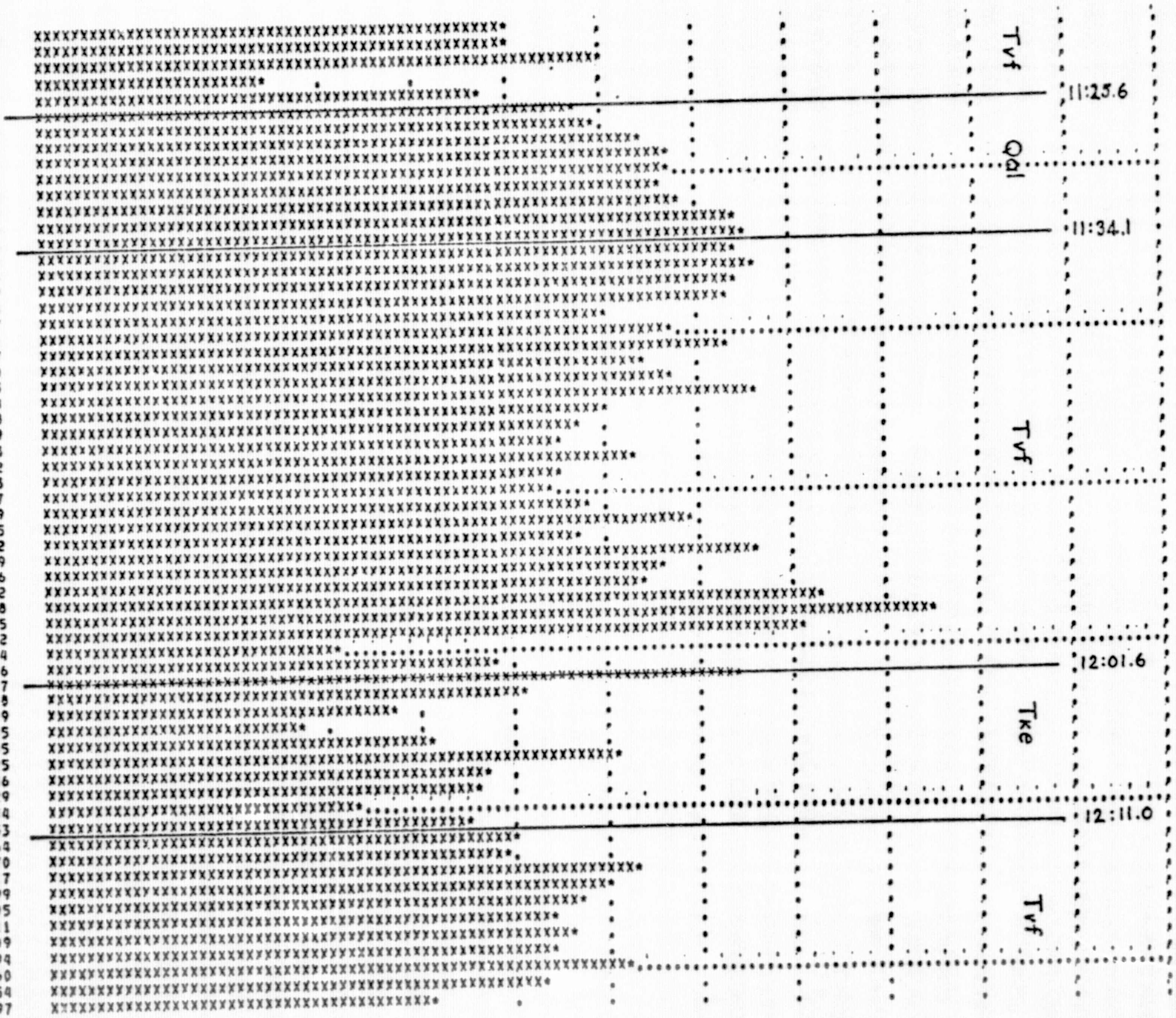

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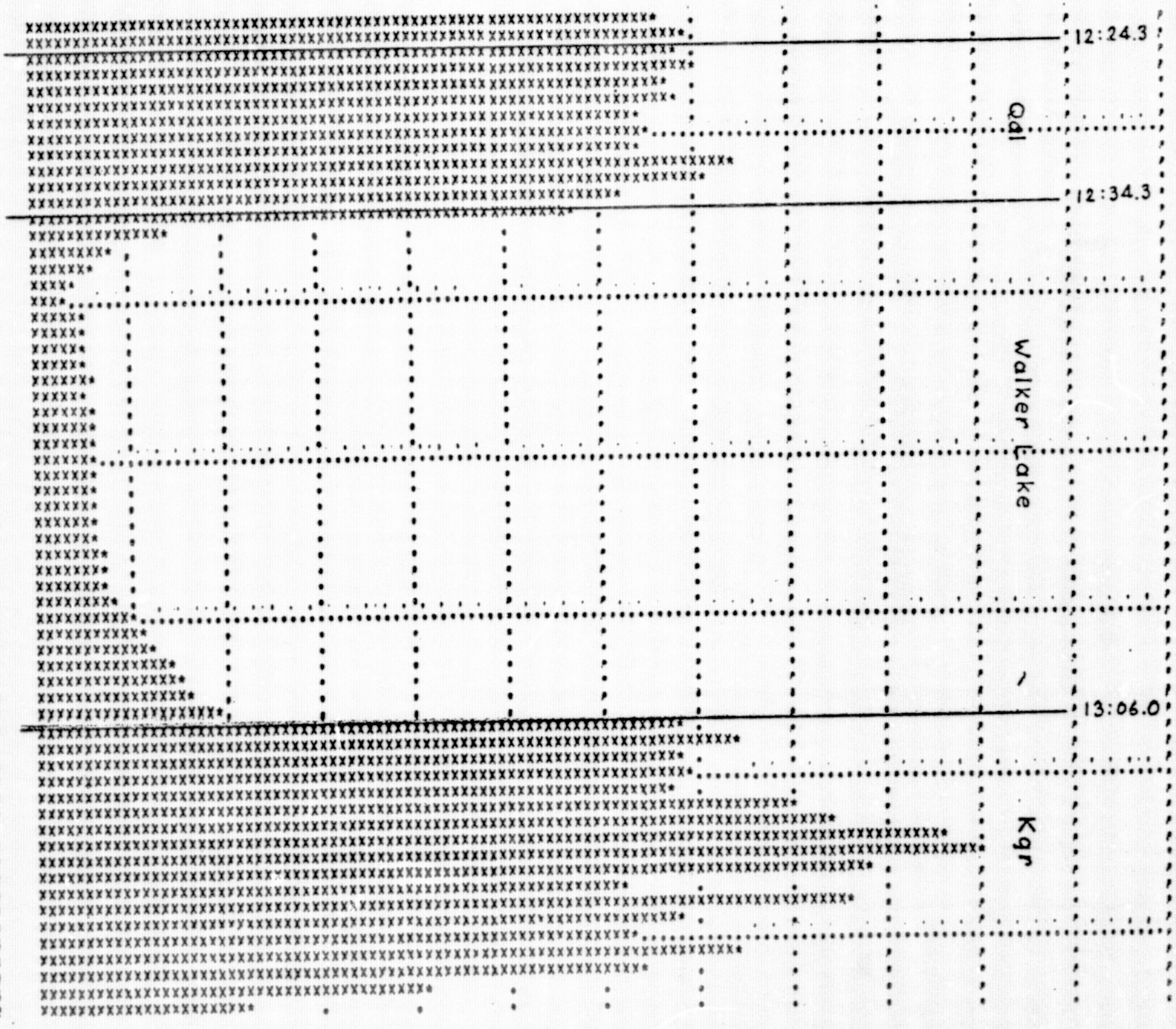

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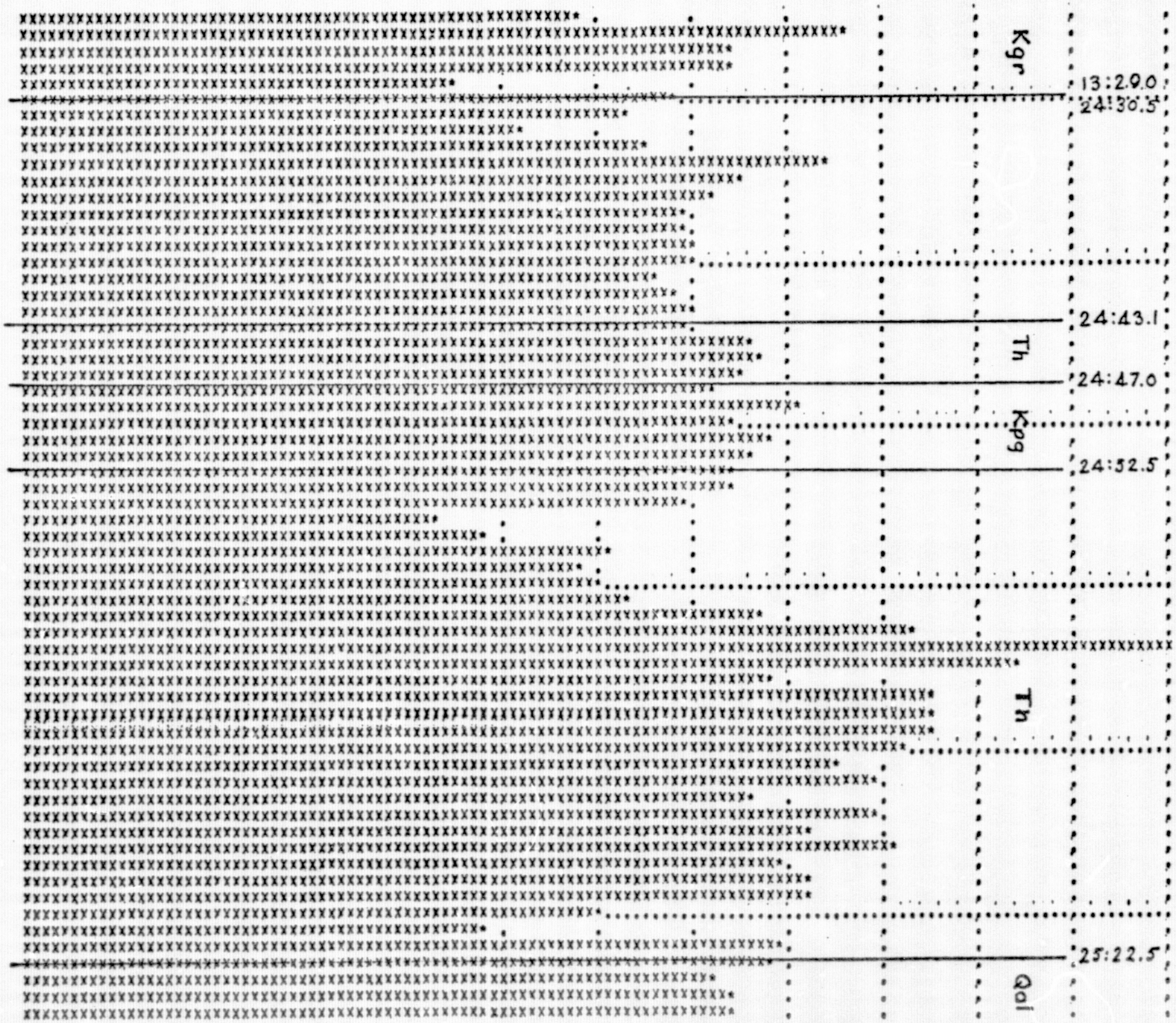

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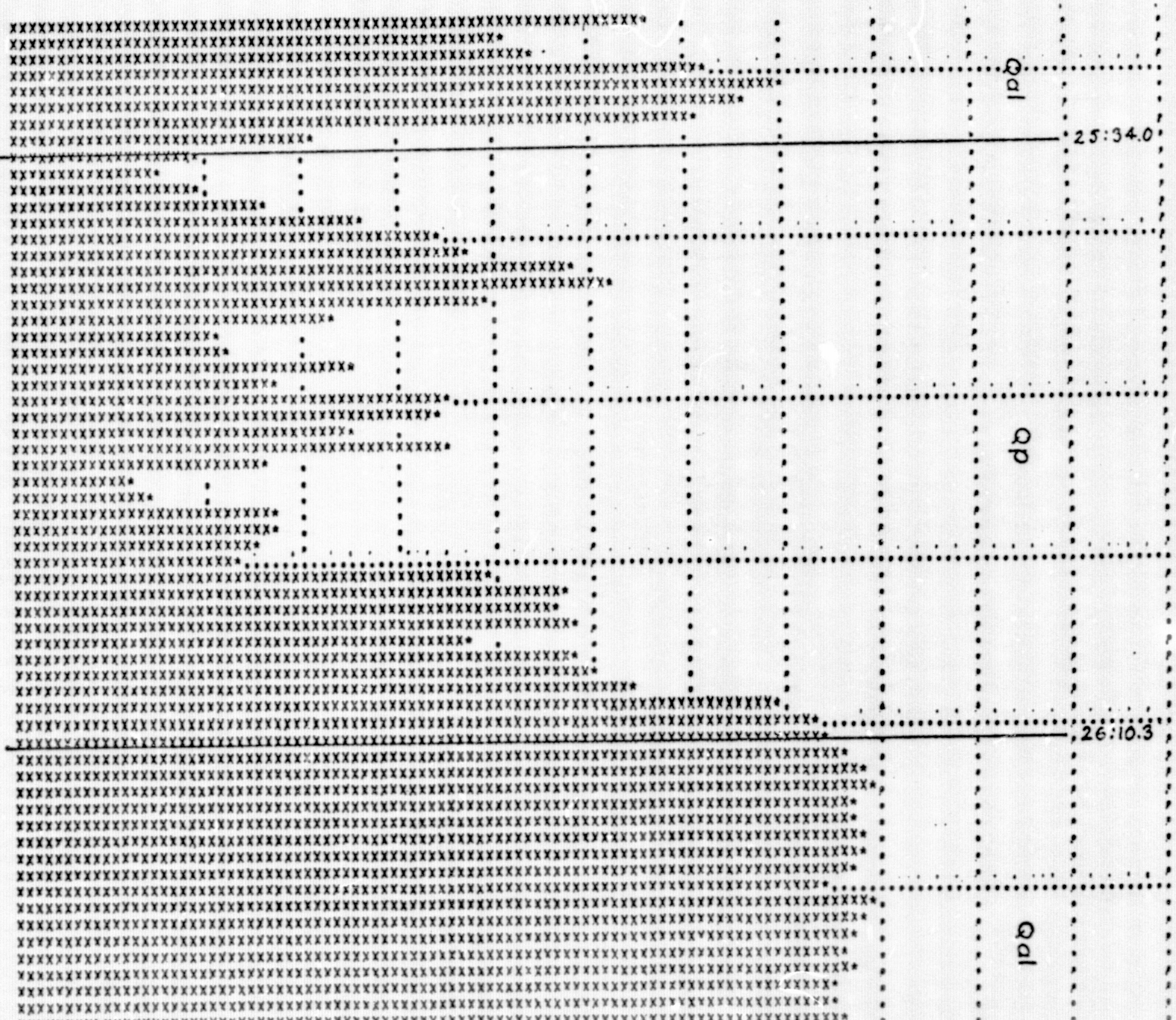

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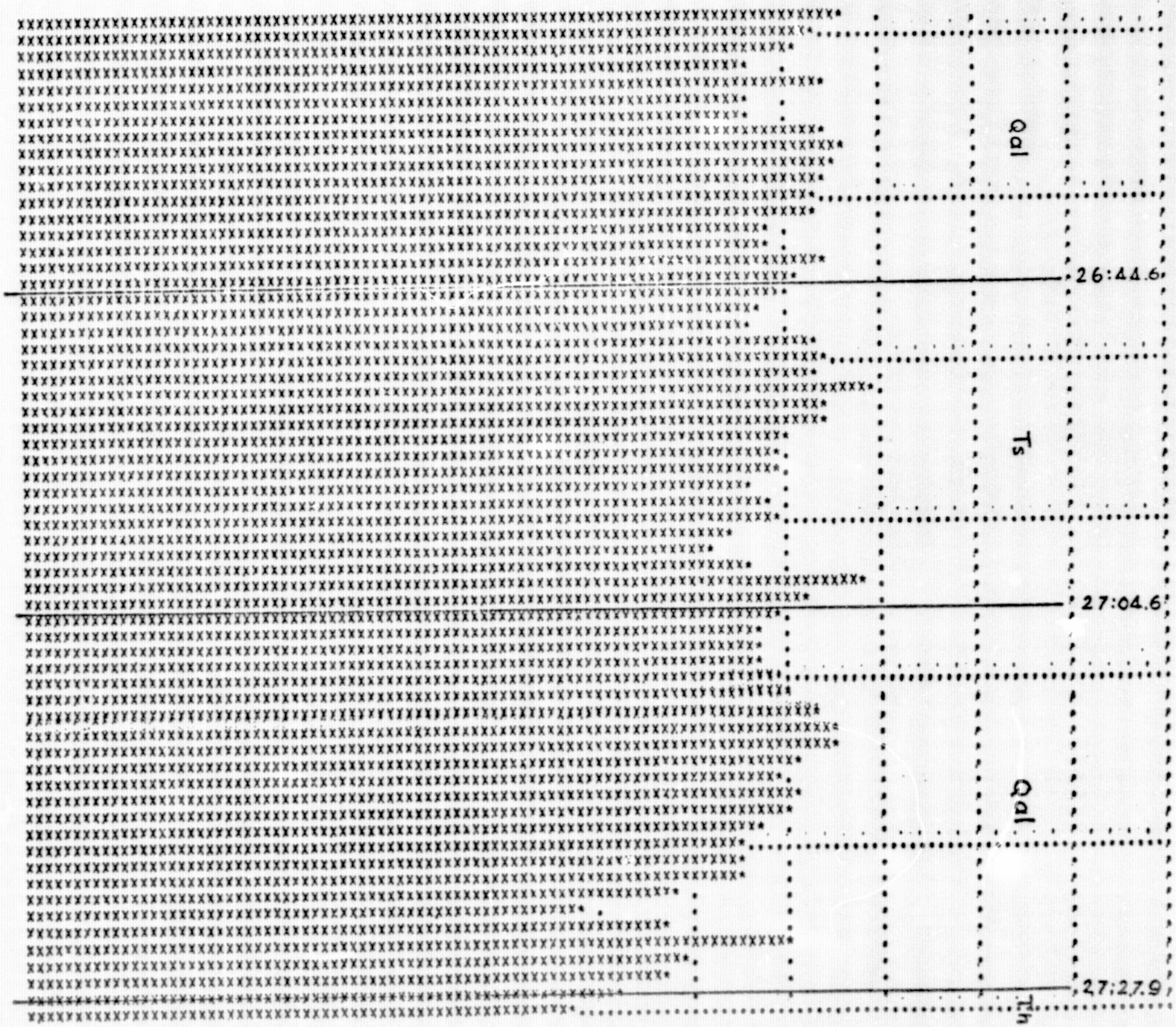

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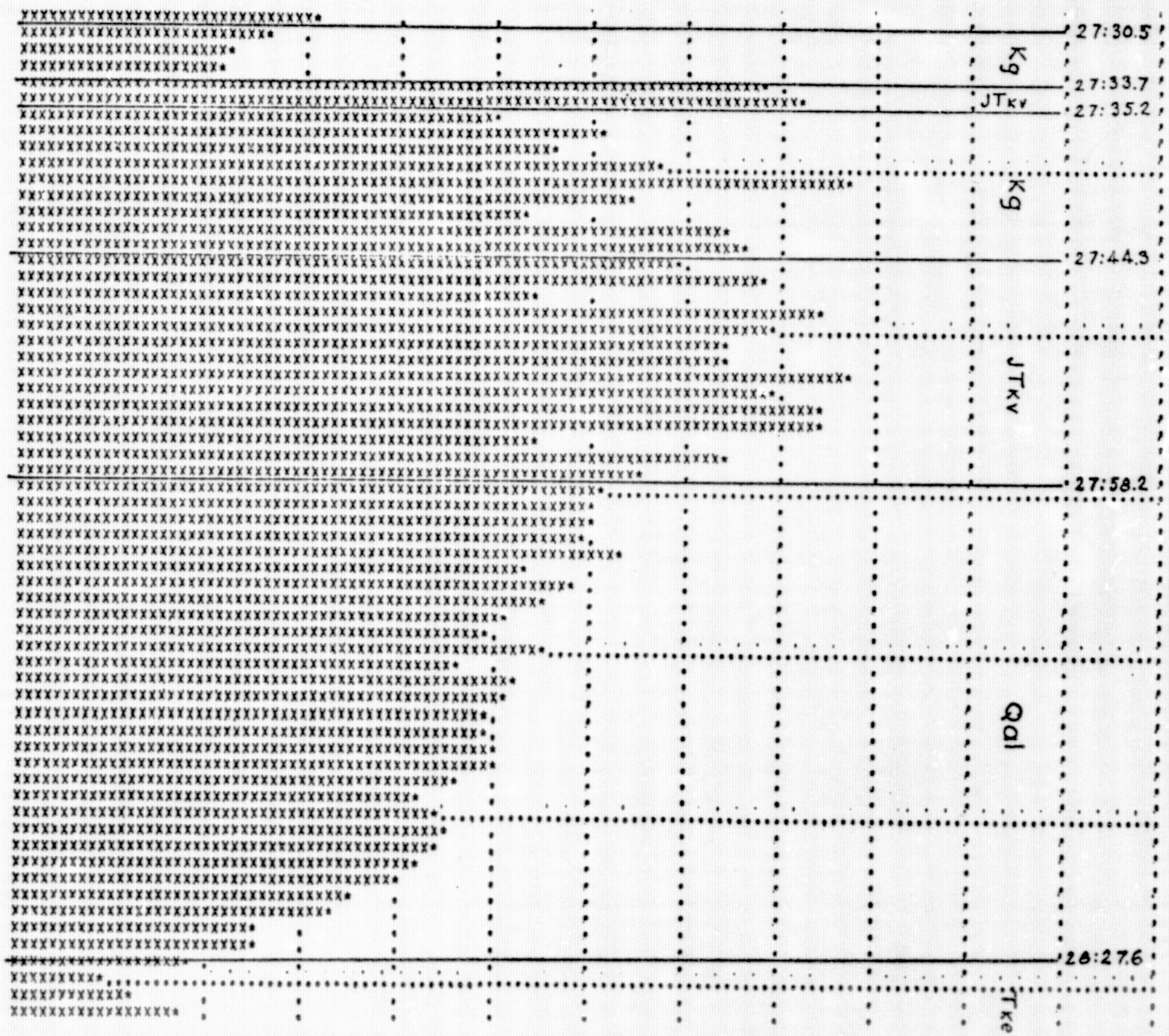

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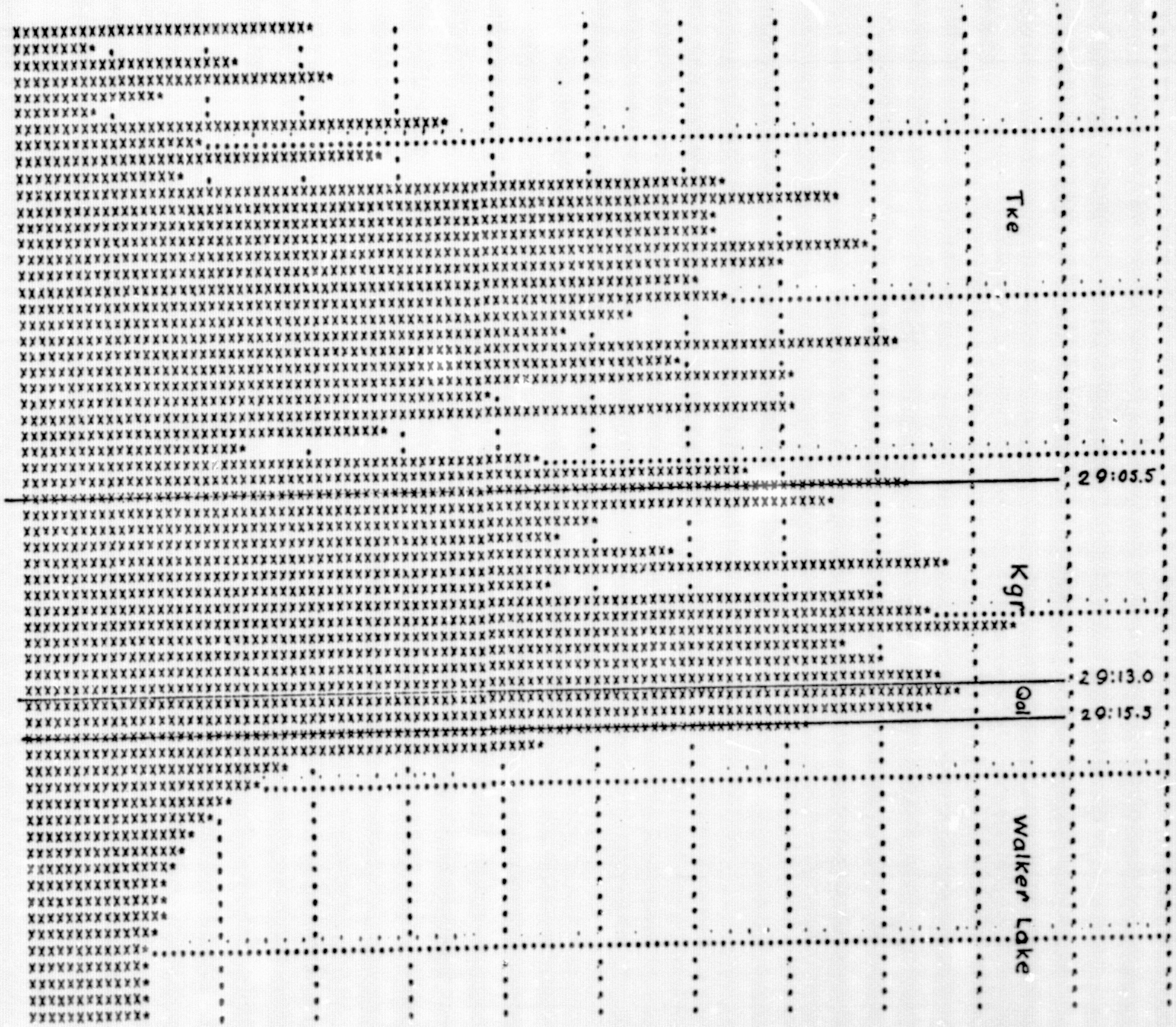

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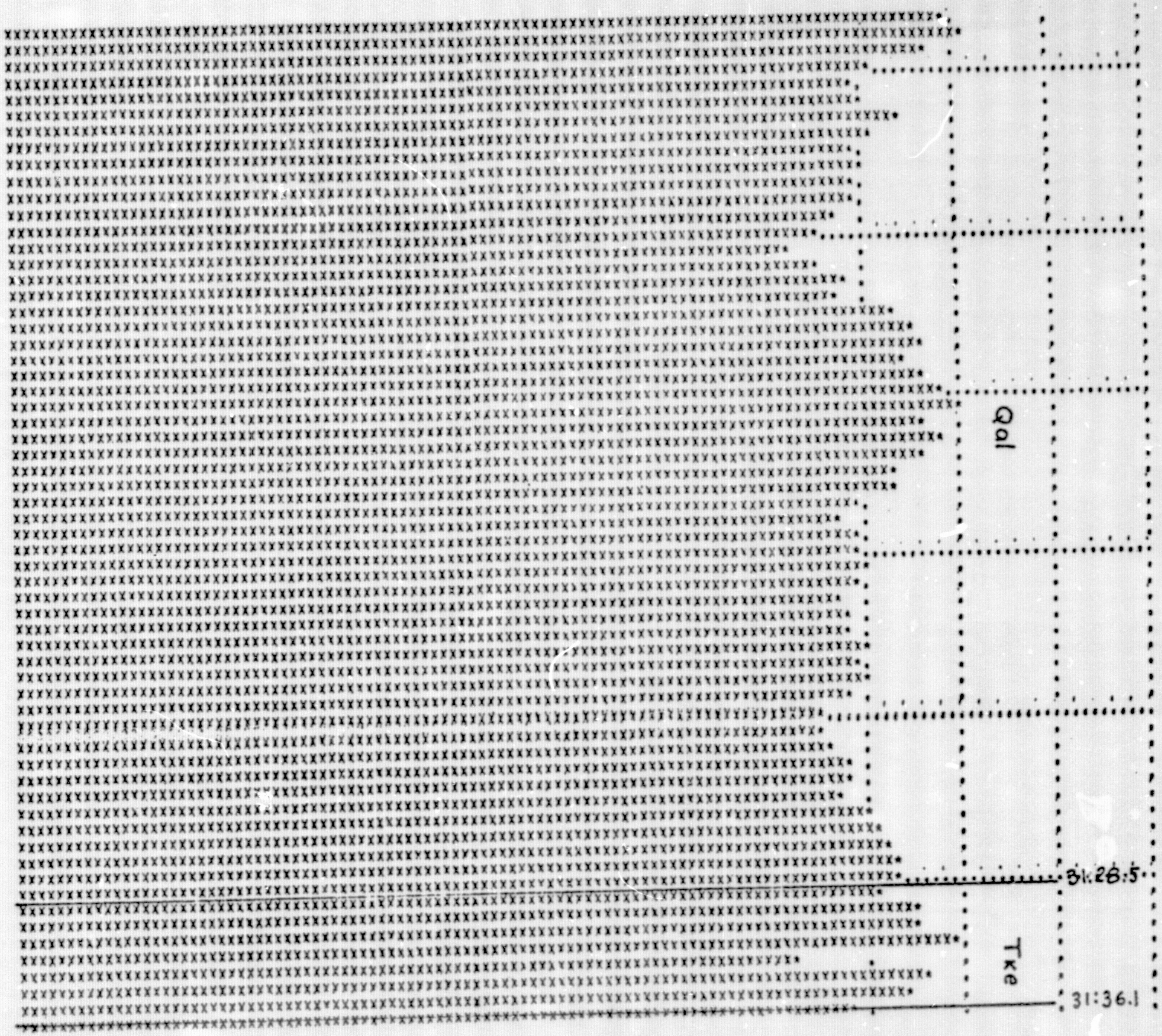

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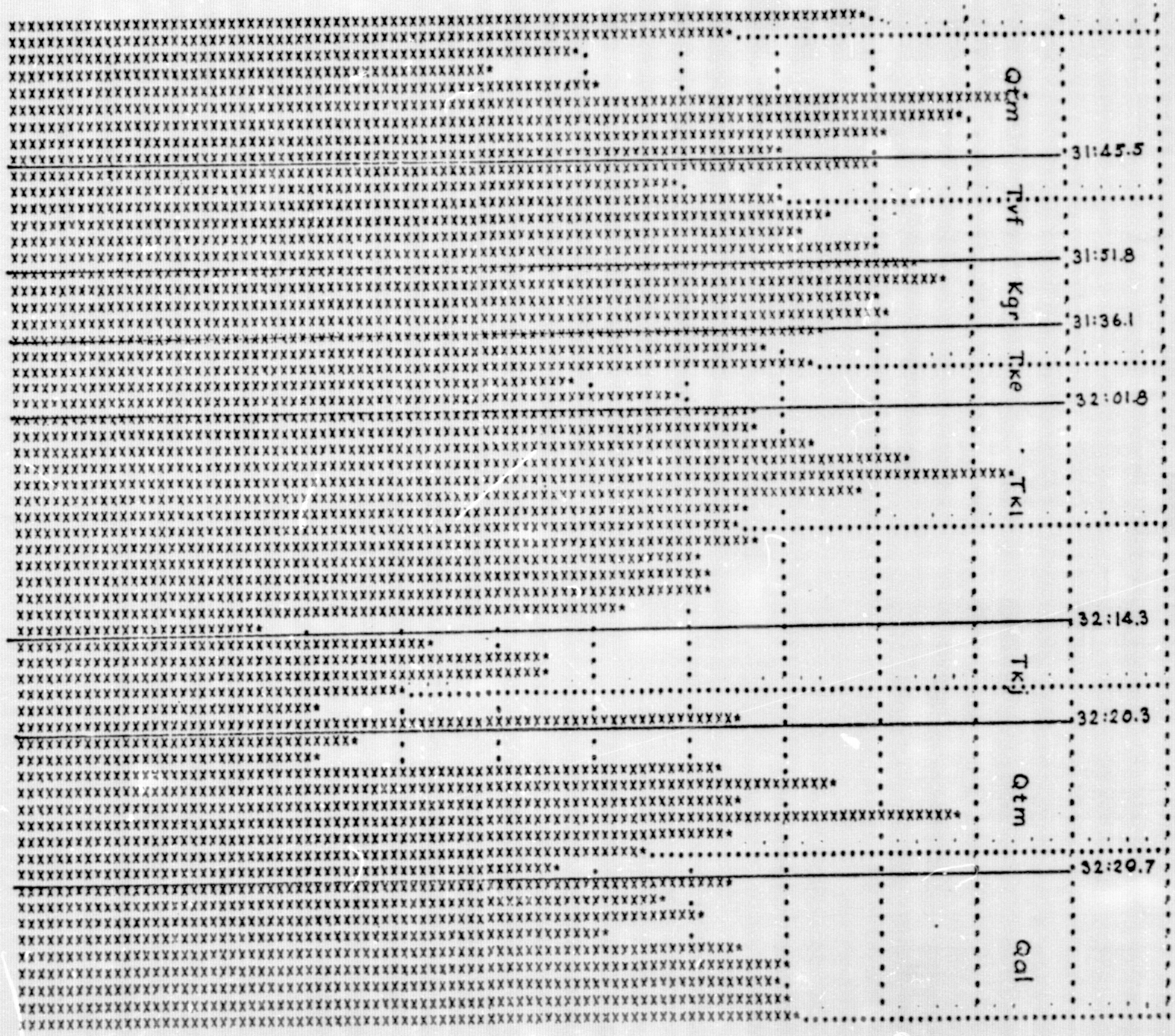

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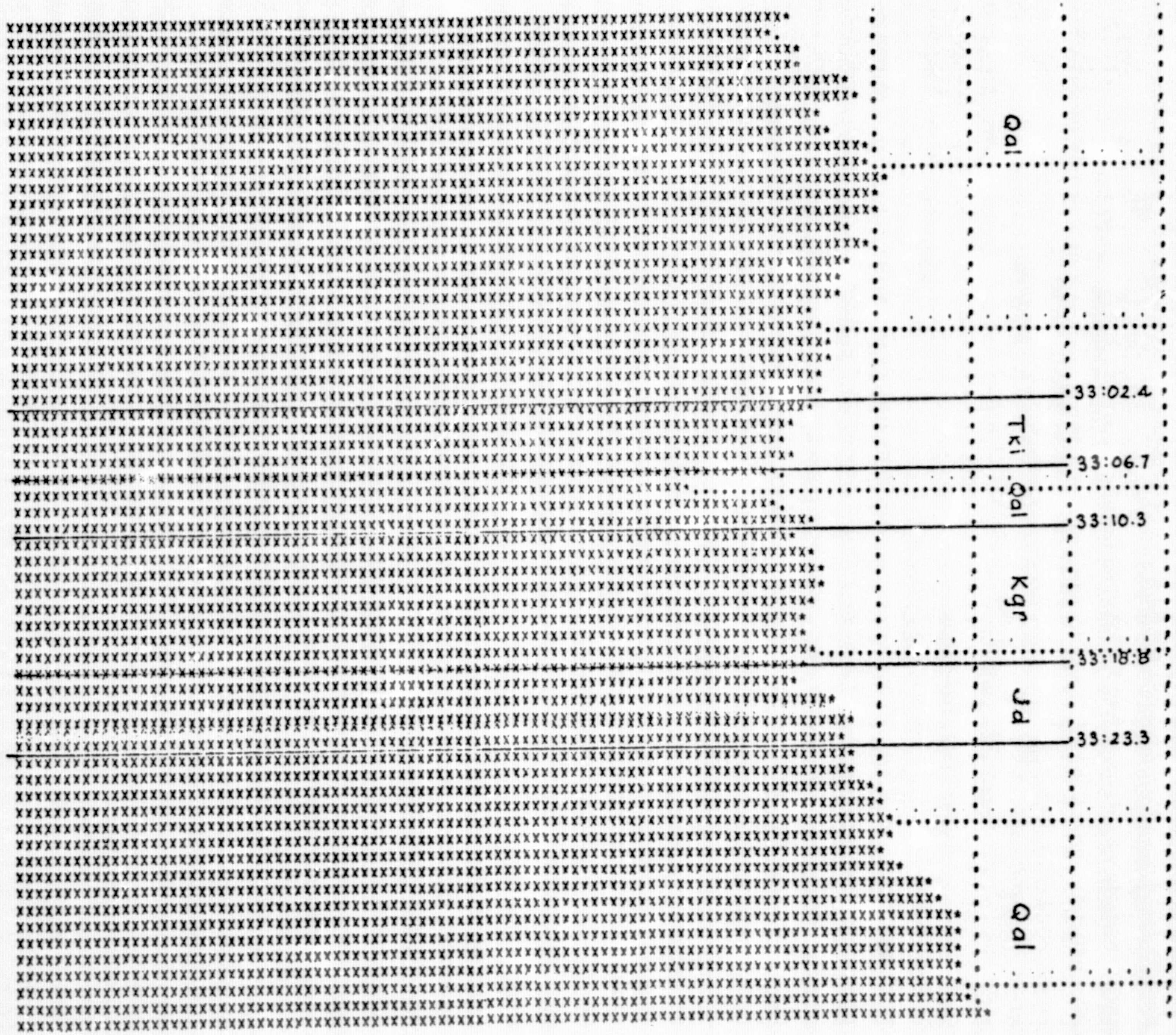

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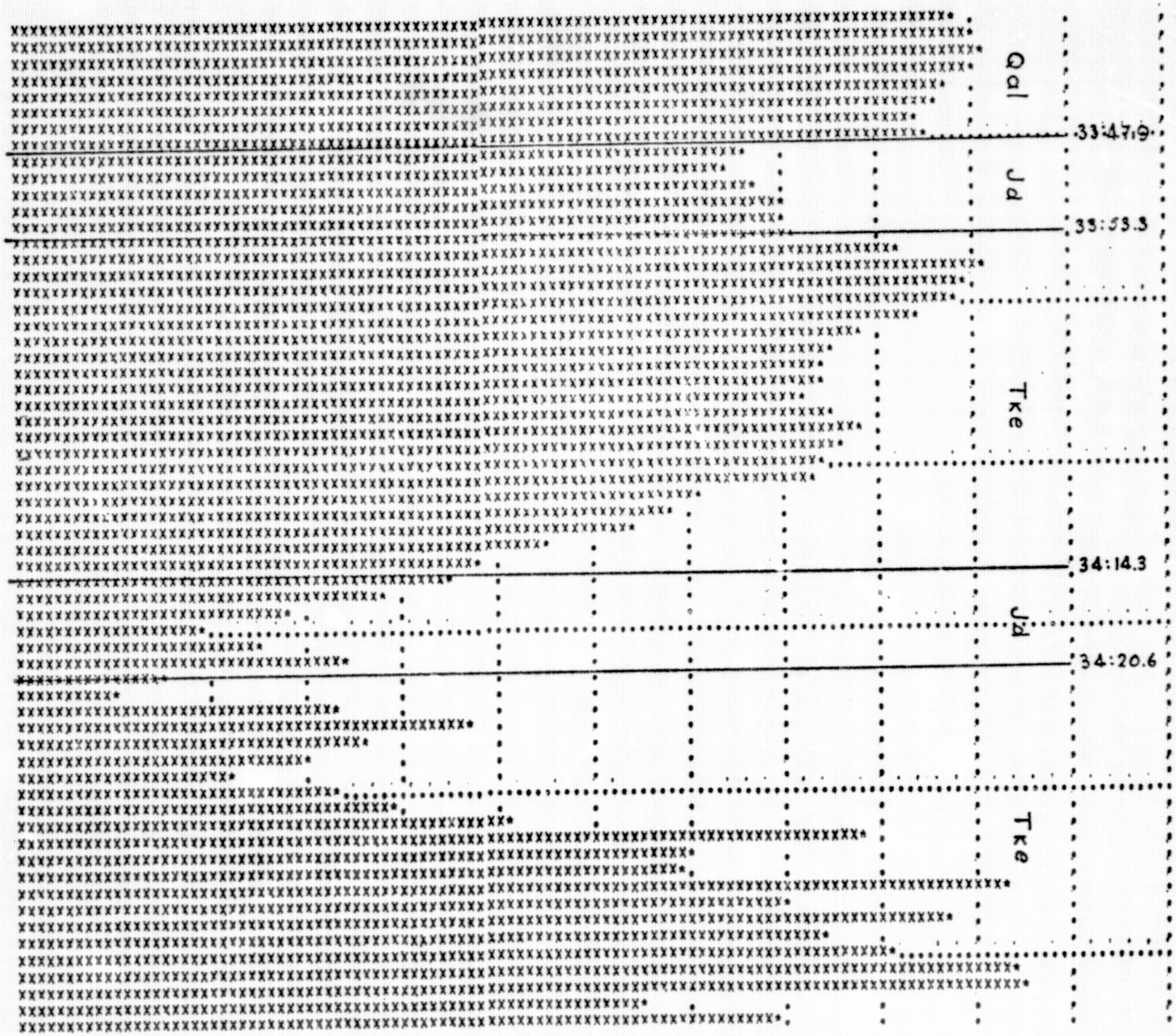

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16:34: 51,378	35,783
16:34: 52,375	35,951
16:34: 53,371	35,589
16:34: 54,368	34,596
16:34: 55,365	35,520
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16:34: 58,355	35,330
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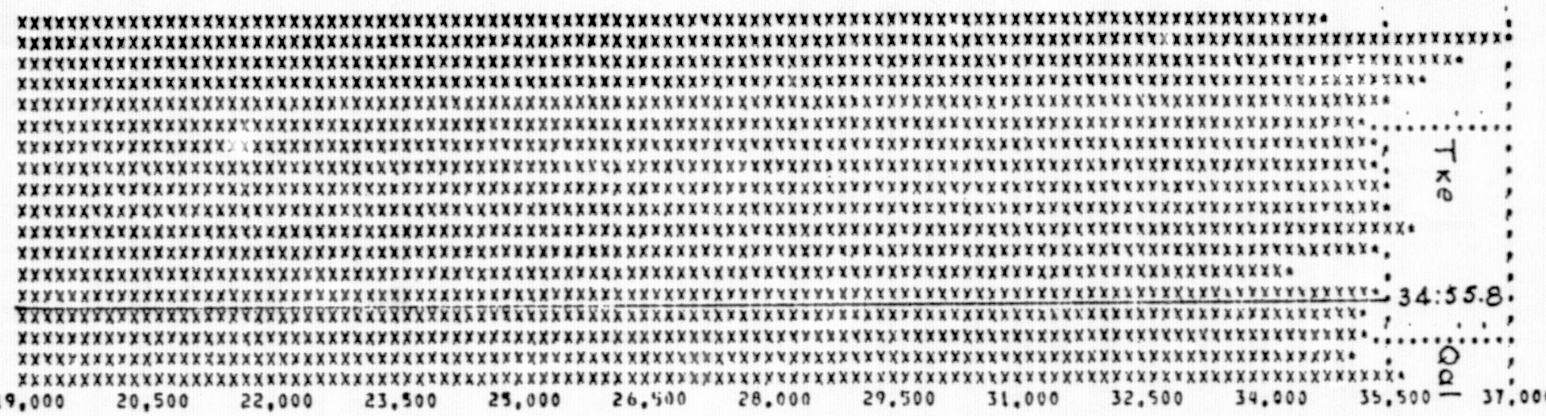


times of passing over terrain features from their radiometric temperatures alone after some practice. Terrain of relatively even temperature could be selected for from greybody emittance identified with greater certainty than those terrains marked by rapid and marked temperature change in the 4 to 20 sec required to obtain a statistically significant set of spectra.

The test areas selected are presented as figures 4.3.2 A to 4.3.2 D. Photographs enlarged from the 70 mm Hasselblad B/W films also exposed an MX248 and on which the test sites are delineated are shown consecutively numbered Site 1-14 (Yerington to Garfield Flat). Gabbs playa is 15.

In selecting study areas the following criteria was observed:

a. The formation type should be of sufficient breadth across the line of flight to permit the recording of at least five (5) spectra, with an allowance for the possible misalignment of the boresight camera and other sensors as well as the dispersion of their recording of their shutter-trip pulses. That is the ground-track equivalent of all the delta-times between Type 1 and Type 4 times (table 3.1.1 above) was allowed before the start (and after the stop) time of each terrain site selected for spectral slides.

b. Insofar as possible the surface temperature as recorded by the airborne radiometer should be relatively constant across the selected study interval.

c. Relatively simple and homogeneous surficial materials of geological interest were selected for study and a visual study of the RC8 images was made to record aberrant details. For example the dumps of the Yerington open-pit copper mine and the soil-covered, ammunition storage bunkers on the alluvium south of Walker Lake, were identified carefully both on the spectral data as well as the photography.

3.2 SKYLAB (SL3, Track 6, day 223)

As with the RB57 IR boresight camera, it is critical to establish <u>within the spectral data itself</u> the correlation between time-of-crossing of temperature contrasts (like shorelines of lakes) and the coincidence of the cross-hairs passing over the <u>same</u> feature. In our early analysis of the SL2 data on Mono Lake we noted a discrepancy (a marked radiance drop) while the boresight camera of S-191 still recorded the field of view as being on the warmer land of Paoha Island. This would have required a

cross-flight-path error allowance, which would have worried as greatly had we continued analysis of the data from such a small target. This type of problem did not appear in our analysis of SL3 over Walker Lake and Garfield Flat because of the relatively large size of both targets to the field of view.

3.2.1 Day 223 Data

The time-on-target is obtained by visual study of the DAC imagery and its time records. Figure 3.2.1 is a profile of the track during which the data relative to S-191 were obtained. The times-on-target of Walker Lake and Garfield Flat are noted as well as approximate angles of target-acquisition and leaving. Again, as in the aircraft mission, care has been exercised in selecting spectral target time intervals such that any telescope zoom wander and misalignment or record/exposure dispersion will not disrelate the spectra studied from the target selected. Spectra at maximum depression angle and near vertical as well as approximately midway between were selected on Walker Lake. Garfield Flat was scanned at near vertical. The intervals selected were always at maximum zoom (high magnification) so that the greatest certainty of identifying and remaining on target during the spectra record interval was possible.

3.2.2 S-191 Spectral Data

From the S-191 data records the following intercepts were selected for detailed study:

a. <u>Walker Lake</u>

  i. 45° forward view. N = 8; 15:26:12.00 to 15:26:20.00 (probably contaminated with Lake Shore because of the high standard deviation in the silicate areas (7.6 to 11.0 μm))

  ii. 28°-mid forward view. N = 7; 15:26:41 to 15:26:49

  iii. Nadir view. N = 8; 15:27:8 to 15:27:16 (standard water)

b. <u>Garfield Flat</u>

  i. Nadir view. N = 5; 15:27:29 to 15:27:34

3.2.2.1 <u>Forward acquisition, tracking-and-hold</u>. At the extremes of forward viewing (around 45°) it appears that the maximum difference between fields of view of the spectrometer and the boresight camera

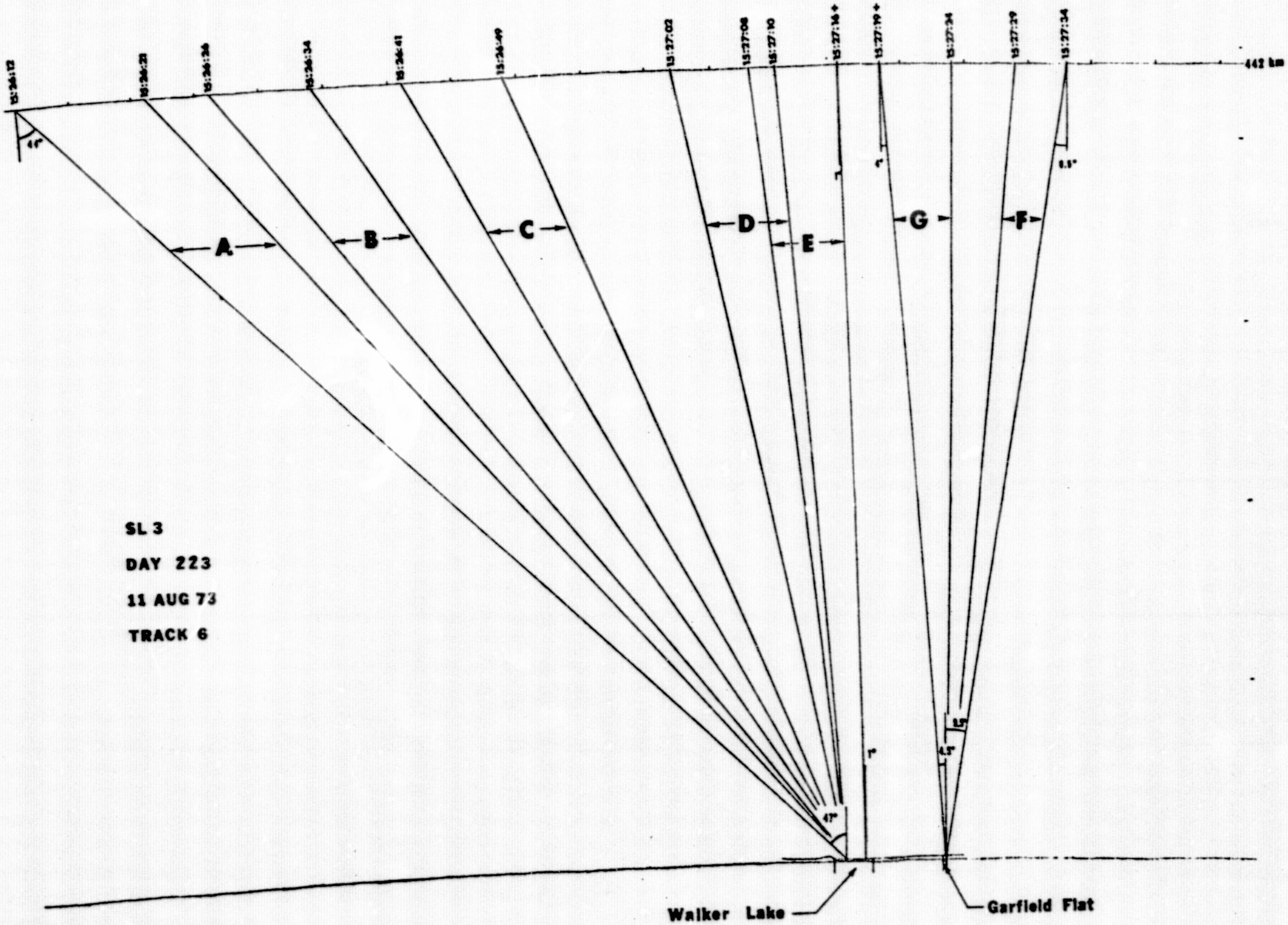


Figure 3.2.1 Profile for SL3, Day 223 11 August 1973, Track 6

Table 3.2.2

Time-on-Target and View Angles of Walker Lake
(SL3, day 223, 11 August 1973)

	GMT time	Angle at spacecraft (to local vertical)	Angle on ground plane (to local vertical)
a. First acquisition	15:26:12– 15:26:20	44° 41	47° 42
b. Mid point lake	15:26:41– 15:26:49	28 22.5	30 23.5
c. Nadir lake	15:27:8– 15:27:16	1 1	1 1
d. Forward sweep and acquisition of Garfield Flat	15:27:19 (many spectra* are missing)	4	4.5
e. Last back-view hold on Garfield Flat	15:27:29– 15:27:34	-3.5 -8.5	-5.0 9.5

Spacecraft altitude = 442 km

Angles calculated presuming a curved orbit and curved terrain (see fig. 3.2).

*Table 4.3.3 lists spectra times actually present on the S-191 tape.

occurred. The standard deviation of data for Walker Lake at this angle is much too high (and primarily in the silicate reststrahlen region); thus we feel confident that this data set represents lake water + rocky shore. A similar problem occurred but at near nadir on SL2 when the spectrometer radiance dropped sharply while the camera indicated Paoha Island still, indicative of intersection of the surrounding (cooler) water erroneously included in the land spectra.

3.2.2.2 Sweeping forward in nadir-lock. The rapid motion of the spacecraft effectively precluded any sensible spectra being obtained even in the 1 sec period required by a single spectrum. The situation was even worse when the S-191 optics were being swept forward to a new site even faster than the spacecraft motion. An example of this is the

SL3 period between 15:27:16 on Walker Lake and 15:27:19 when Garfield Flat was acquired. In that 3 sec. span over 40 km (25 mi) of terrain was swept past the field of ivew, covering 14 completely different rock and soil types (see map on fig. 2.2).

4. SPECTRAL DATA

4.1 RB57 Pallet Spectra

The times between which pallet spectra were required were established and that position of the MX248 spectrometer tape read into memory, selecting only the up-ramp sequence. The typical data format for output is shown in table 4.1 and plotted in figure 4.1 for a sequence of 22 spectra over the south end of Walker Lake, day 223, 16:29:40 to 16:30:00. The wavelength sequences, L(N), were established from a separate listing provided in 1971 (see discussion section 2.3). The column headed by ET(N) is equivalent to radiance, and the standard deviation of each data point, for N spectra, is headed by SDEV. The equivalent blackbody temperature TT(N) for each data point forms the fourth column, the whole set being repeated for L = 9.91 to L = 13.00 μm. Other data printed out were MAX TT(N) and the wavelength L(N) at which it occurred, and housekeeping data (spectrometer blackbody temperature SPRBBT; detector temperature SPEDET; internal (reference) blackbody temperature SPIBBT; and radiometer internal (reference) blackbody temperature RAIBBT).

4.1.1 Fitting Blackbody Envelope to Maximum Radiance of Earth Target

The plotted radiance data (fig. 4.1) also carried a blackbody radiance envelope calculated for MAXTT(N) in degrees absolute. All radiance plots were made with fixed ordinates; the standard deviations however were scaled up to occupy about one-third of the ordinate, and their vertical scales are given on each output in terms of S-AVG; SMAX; and SDELTA. Radiance scale factors (fixed) were given on each plot as XMIN; XMAX; and DELTA. On most radiance plots a S-value of 0.6 and 0.3 has been indicated on the S-curves blacked in above 0.3.

Titles could be accepted and printed out on both tabular and plotted data sets. Times of stop and start for the spectra were similarly indicated.

Table 4.1

Typical MX248 Spectrometer Output
Walker Lake South

L(N)	ET(N)	SDEV	TT(N)	L(N)	ET(N)	SDEV	TT(N)
6.66	.567@8	.590@6	-19.8	9.91	.243@9	.562@6	12.2
6.70	.580@8	.697@6	-19.9	9.98	.253@9	.536@6	14.3
6.78	.609@8	.860@6	-19.5	10.06	.263@9	.527@6	16.7
6.84	.644@8	.883@6	-18.7	10.13	.274@9	.602@6	19.0
6.92	.733@8	.869@6	-15.8	10.21	.281@9	.627@6	20.7
6.98	.813@8	.851@6	-13.3	10.29	.285@9	.620@6	21.6
7.07	.896@8	.831@6	-11.2	10.37	.287@9	.737@6	22.0
7.12	.964@8	.997@6	-9.49	10.44	.287@9	.740@6	22.2
7.21	.106@9	.102@6	-7.23	10.50	.286@9	.666@6	22.2
7.27	.113@9	.102@6	-5.67	10.58	.286@9	.621@6	22.3
7.35	.121@9	.940@6	-4.01	10.65	.286@9	.568@6	22.3
7.42	.130@9	.890@6	-2.20	10.73	.285@9	.529@6	22.4
7.49	.139@9	.787@6	- .437	10.80	.284@9	.506@6	22.3
7.55	.147@9	.772@6	1.12	10.88	.283@9	.456@6	22.3
7.62	.149@9	.639@6	1.05	10.97	.282@9	.464@6	22.4
7.70	.152@9	.626@6	.886	11.03	.281@9	.450@6	22.3
7.78	.155@9	.491@6	1.04	11.11	.280@9	.460@6	22.3
7.84	.157@9	.476@6	.945	11.18	.279@9	.510@6	22.4
7.92	.162@9	.527@6	1.56	11.25	.278@9	.555@6	22.3
7.99	.177@9	.613@6	4.73	11.33	.276@9	.534@6	22.3
8.06	.196@9	.703@6	8.73	11.40	.275@9	.555@6	22.2
8.13	.214@9	.861@6	12.2	11.48	.274@9	.531@6	22.2
8.21	.232@9	.863@6	15.5	11.53	.272@9	.516@6	22.1
8.29	.248@9	.802@6	18.1	11.61	.271@9	.552@6	22.1
8.36	.257@9	.752@6	19.5	11.66	.270@9	.568@6	22.1
8.44	.262@9	.733@6	20.0	11.75	.268@9	.583@6	21.9
8.52	.265@9	.708@6	20.3	11.81	.266@9	.573@6	21.8
8.59	.269@9	.718@6	20.6	11.88	.265@9	.578@6	21.8
8.67	.271@9	.722@6	20.8	11.96	.263@9	.535@6	21.7
8.75	.273@9	.721@6	20.8	12.03	.263@9	.504@6	21.9
8.83	.275@9	.673@6	21.0	12.10	.262@9	.530@6	22.0
8.96	.279@9	.722@6	21.3	12.17	.261@9	.516@6	22.1
8.98	.280@9	.691@6	21.4	12.24	.259@9	.449@6	22.0
9.96	.281@9	.655@6	21.4	12.30	.257@9	.452@6	21.9
9.13	.283@9	.763@6	21.6	12.38	.254@9	.387@6	21.5
9.22	.284@99	.648@6	21.6	12.45	.252@9	.358@6	21.1
9.28	.283@99	.650@6	21.3	12.52	.248@9	.348@6	20.4
9.37	.280@99	.706@6	20.5	12.59	.244@9	.340@6	19.7
9.44	.269@9	.625@6	18.2	12.64	.242@9	.360@6	19.3
9.51	.256@9	.555@6	15.5	12.72	.240@9	.406@6	19.2
9.60	.246@9	.549@6	13.1	12.79	.238@9	.422@6	19.1
9.67	.237@9	.490@6	11.0	12.85	.238@9	.399@6	19.3
9.77	.231@9	.518@6	9.58	12.92	.237@9	.394@6	19.6
9.83	.234@9	.537@6	10.2	13.00	.235@9	.411@6	19.5

MAX TT(N) is 22.4 at 10.7; SPRBBT = 44.8; SPEDET = .963@-2; SPIBBT = 25.9; RAIBBT = 43.4.

Figure 4.1 Spectral emittance
Walker Lake South

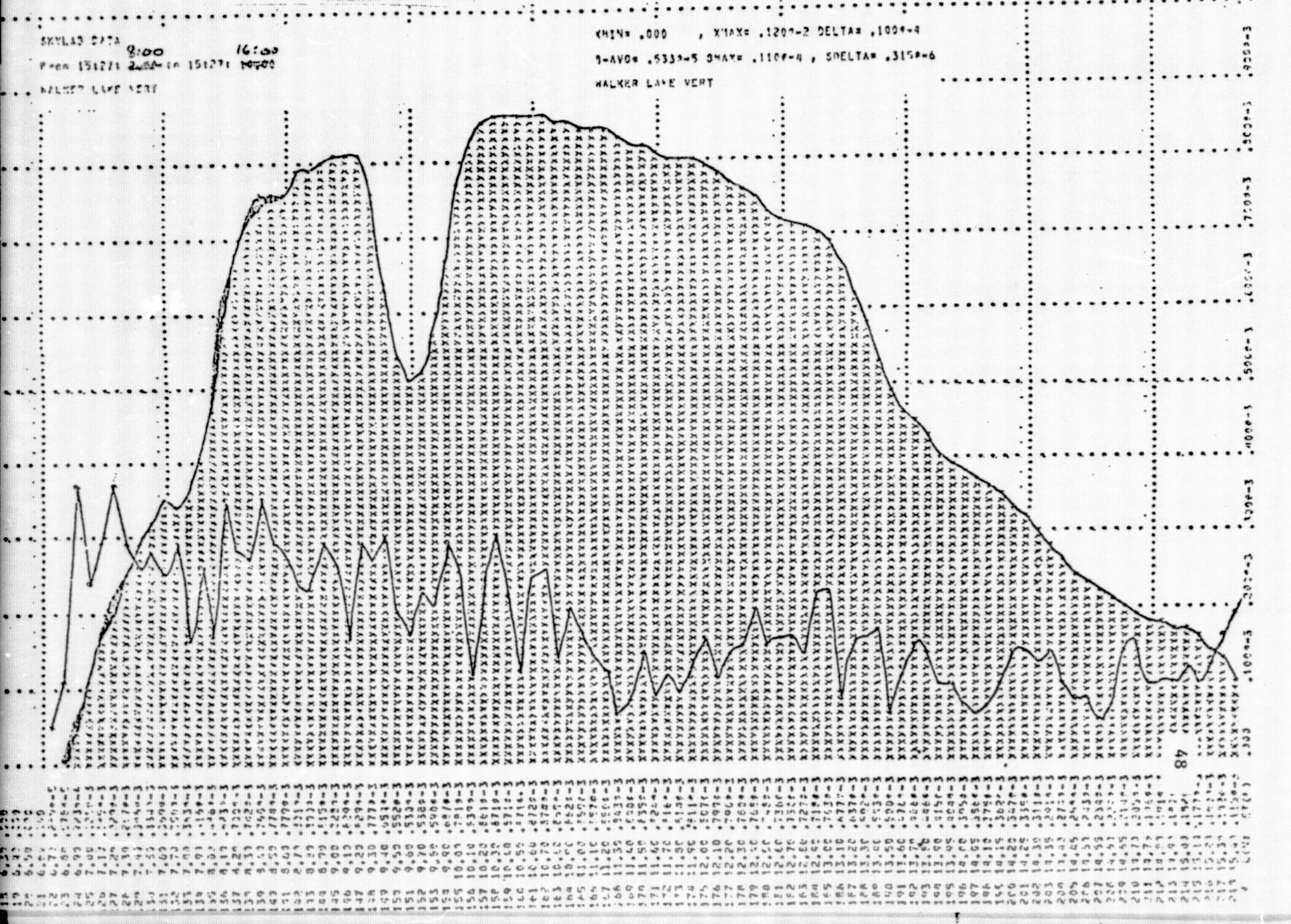


Table 4.1.1. Spectral date, emittance--Yerington Dump (Site 1)

13:19 THU 10 APR 75 Page 1 <ENDUDI>SRL,11

STANFORD REMOTE SENSING LABORATORIES

MISSION 243 (AIRCRAFT DATA), (UP-RAMP SPECTRA)

YERINGTON DUMP

From 16:25: 25.00 to 16:25: 28.50

3 spectra averaged

L(N)	ET(N)	SDEV	TT(N)	BB(N)	L(N)	ET(N)	SDEV	TT(N)	BB(N)
6.66	.59*08	.58*6	-18.13	.223*9	9.91	.262*9	.39*7	16.29	.322*9
6.70	.60*93	.65*6	-18.54	.227*9	9.98	.272*9	.40*7	18.56	.322*9
6.78	.63*9	.30*6	-18.26	.232*9	10.06	.284*9	.41*7	21.17	.321*9
6.84	.67*9	.57*6	-17.32	.236*9	10.13	.296*9	.44*7	23.69	.321*9
6.92	.76*93	.78*6	-14.60	.242*9	10.21	.305*9	.50*7	25.62	.320*9
6.98	.835*8	.13*7	-12.45	.245*7	10.29	.310*7	.52*7	26.77	.319*9
7.07	.918*8	.11*7	-10.40	.251*9	10.37	.312*9	.53*7	27.38	.319*9
7.12	.98*93	.10*7	-8.79	.254*9	10.44	.313*9	.52*7	27.66	.318*9
7.21	.107*9	.10*7	-6.86	.260*9	10.50	.312*9	.49*7	27.78	.317*9
7.27	.111*9	.53*6	-5.30	.263*9	10.58	.312*9	.45*7	27.88	.316*9
7.35	.121*9	.99*6	-4.07	.267*7	10.65	.312*9	.44*7	28.06	.315*9
7.42	.130*9	.11*7	-2.27	.271*9	10.73	.311*9	.44*7	28.21	.314*9
7.49	.140*9	.53*6	-.33	.275*9	10.80	.310*9	.44*7	28.24	.313*9
7.55	.139*9	.33*5	1.43	.277*7	10.83	.310*7	.46*7	28.29	.312*9
7.62	.151*9	.25*6	1.51	.231*9	10.97	.308*9	.44*7	28.36	.310*9
7.70	.154*9	.11*7	1.62	.284*9	11.03	.307*9	.42*7	28.34	.309*9
7.78	.159*9	.19*7	2.05	.288*9	11.11	.306*9	.42*7	28.36	.308*9
7.84	.161*9	.19*7	2.10	.291*7	11.13	.305*7	.43*7	28.42	.306*9
7.92	.163*9	.24*7	3.09	.294*9	11.25	.304*9	.40*7	28.40	.305*9
7.99	.196*7	.34*7	6.96	.296*9	11.33	.302*7	.40*7	28.34	.303*9
8.06	.210*9	.42*7	11.77	.299*9	11.40	.300*9	.42*7	28.34	.302*9
8.13	.232*9	.47*7	15.91	.301*9	11.48	.299*9	.41*7	28.30	.300*9
8.21	.253*9	.52*7	19.61	.304*7	11.53	.297*9	.40*7	28.26	.299*9
8.29	.272*9	.57*7	22.63	.306*9	11.61	.296*9	.41*7	28.30	.298*9
8.36	.232*9	.55*7	24.23	.308*9	11.66	.295*9	.41*7	28.21	.297*9
8.44	.287*9	.56*7	24.69	.310*7	11.75	.292*9	.37*7	27.99	.295*9
8.52	.290*9	.55*7	24.92	.312*9	11.81	.290*9	.35*7	27.93	.293*9
8.59	.294*9	.55*7	25.28	.313*9	11.88	.289*7	.35*7	27.98	.292*9
8.67	.296*9	.53*7	25.35	.315*9	11.96	.287*9	.36*7	28.05	.290*9
8.75	.297*9	.55*7	25.28	.316*7	12.03	.287*9	.35*7	28.34	.288*9
8.83	.299*9	.57*7	25.46	.317*9	12.10	.287*9	.34*7	28.68	.287*9
8.96	.302*9	.61*7	25.65	.319*9	12.17	.285*9	.33*7	28.82	.285*9
8.98	.302*9	.64*7	25.62	.320*9	12.24	.284*9	.32*7	28.76	.284*9
9.06	.303*9	.66*7	25.55	.320*9	12.30	.281*9	.32*7	28.55	.282*9
9.13	.303*9	.69*7	25.56	.321*9	12.39	.278*9	.33*7	28.16	.280*9
9.22	.304*9	.69*7	25.45	.322*9	12.45	.274*9	.32*7	27.54	.278*9
9.28	.303*9	.68*7	25.13	.322*9	12.52	.269*9	.30*7	26.44	.277*9
9.37	.293*9	.63*7	23.20	.323*9	12.59	.263*9	.25*7	25.39	.275*9
9.44	.287*9	.57*7	21.81	.323*9	12.64	.260*9	.26*7	24.81	.274*9
9.51	.273*9	.51*7	18.95	.323*9	12.72	.258*9	.25*7	24.63	.272*9
9.60	.262*9	.46*7	16.68	.323*9	12.79	.256*9	.25*7	24.62	.270*9
9.67	.253*9	.40*7	14.58	.323*9	12.85	.256*9	.28*7	25.01	.268*9
9.77	.248*9	.39*7	13.29	.323*9	12.92	.256*9	.28*7	25.50	.267*9
9.83	.252*9	.39*7	14.10	.323*9	13.00	.254*9	.30*7	25.51	.265*9

MAX TT(N) IS 28.82 AT 12.17

SPRBBT= 44.74 , SPECET= .9627*-2 , SPIBBT= 26.06 , RAIBBT= 44.44

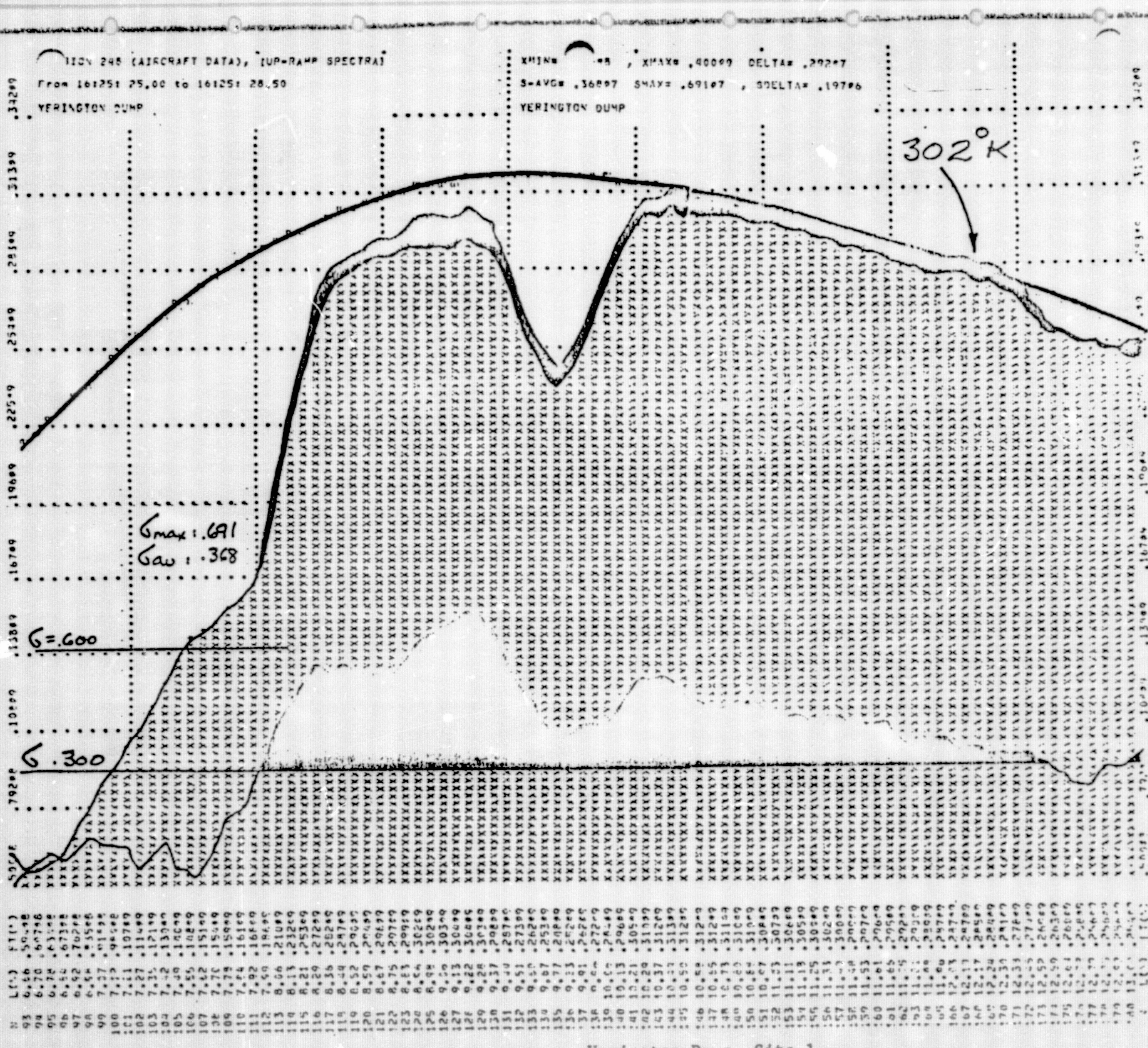
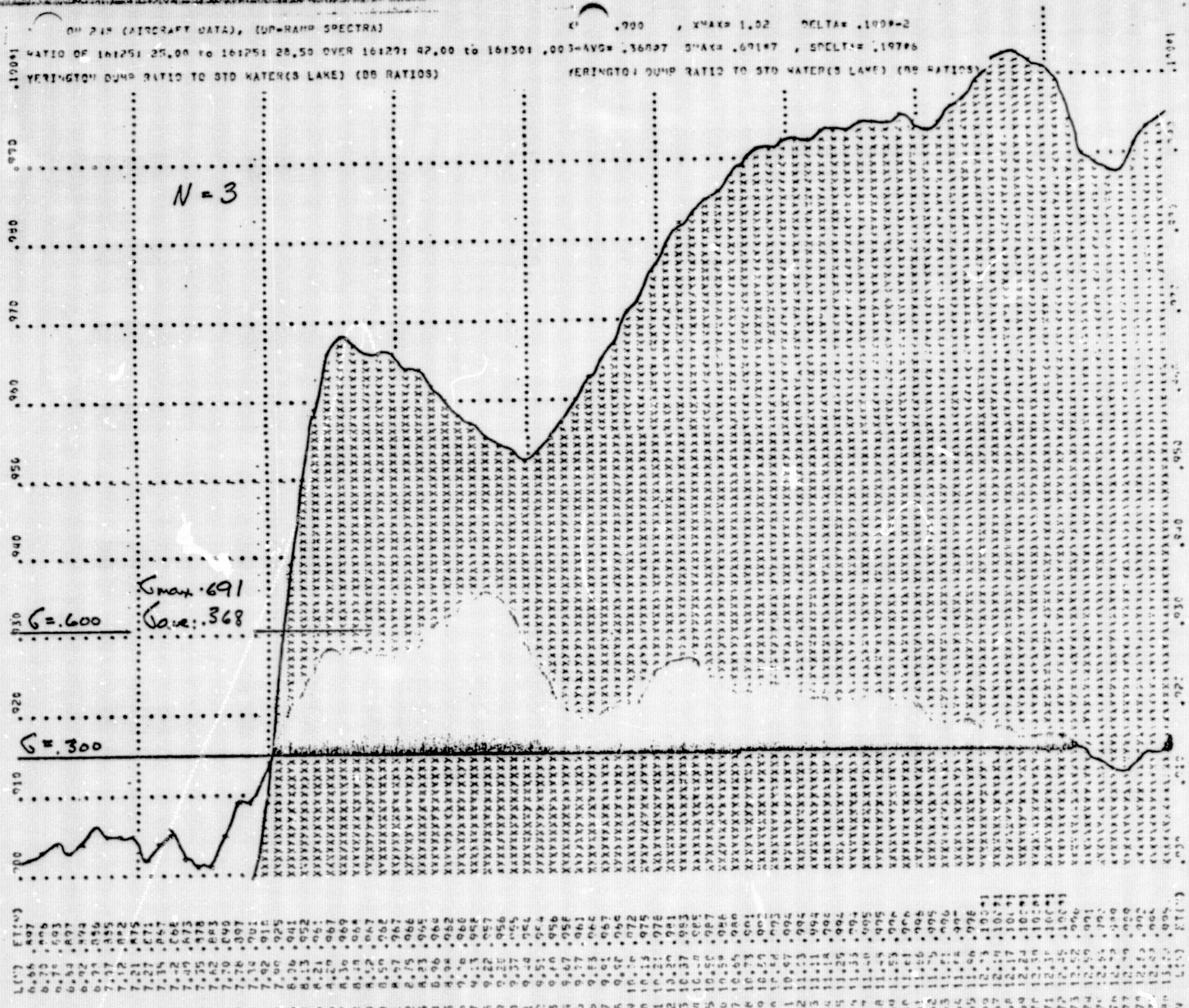


Figure 4.1.1.1 Target emittance Yerington Dump--Site 1



4.1.1.2 Ratio to water--Yerington Dump (Site 1)

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OF POOR QUALITY

Table 4.1.2 Spectral data, emittance--Qal-1 (Site 2)

STANFORD REMOTE SENSING LABORATORIES

MISSION 248 (AIRCRAFT DATA), (UP-RAMP SPECTRA)

QAL-1

From 16:26: 13,00 to 16:26: 23,00

11 spectra averaged

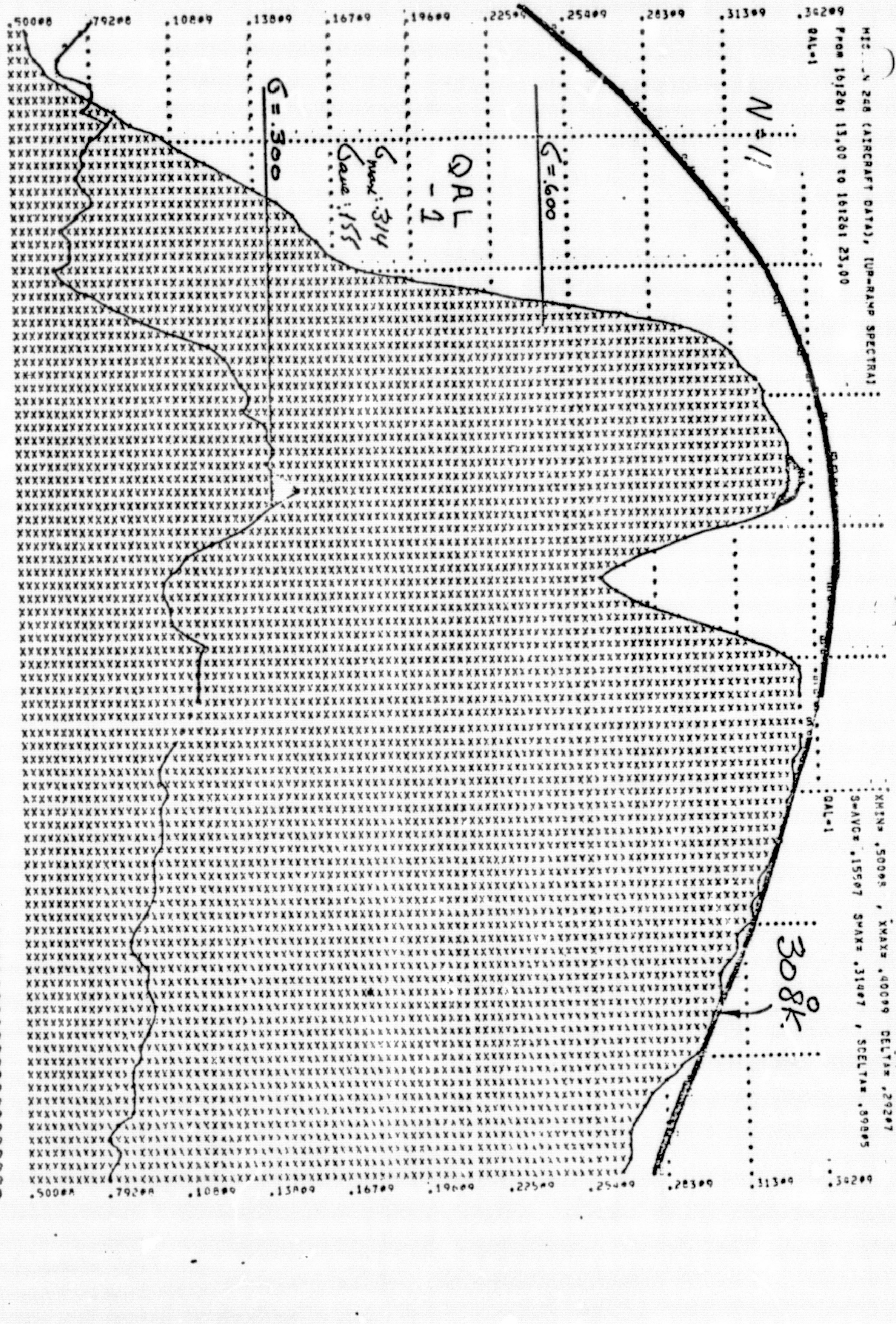
L(N)	ET(N)	SDEV	TT(N)	BB(N)	L(N)	ET(N)	SDEV	TT(N)	BB(N)
6,66	,592#8	,82#6	-18,54	,255#9	9,91	,284#9	,17#7	21.09	,353#9
6,70	,605#8	,64#6	-18,62	,258#9	9,98	,296#9	,17#7	23,62	,352#9
6,78	,634#8	,61#6	-18,28	,264#9	10,06	,310#9	,20#7	26,47	,351#9
6,84	,668#8	,58#6	-17,56	,269#9	10,13	,323#9	,21#7	29,24	,350#9
6,92	,757#8	,92#6	-14,81	,275#9	10,21	,333#9	,20#7	31,37	,349#9
6,98	,836#8	,97#6	-12,39	,277#9	10,29	,339#9	,20#7	32,59	,348#9
7,07	,920#8	,85#6	-10,34	,284#9	10,37	,341#9	,20#7	33,23	,347#9
7,12	,990#8	,11#7	-8,58	,288#9	10,44	,342#9	,20#7	33,56	,346#9
7,21	,108#9	,96#6	-6,51	,293#9	10,50	,341#9	,19#7	33,66	,345#9
7,27	,115#9	,90#6	-5,06	,297#9	10,58	,340#9	,18#7	33,75	,344#9
7,35	,123#9	,90#6	-3,44	,302#9	10,65	,340#9	,17#7	33,99	,343#9
7,42	,132#9	,81#6	-1.58	,305#9	10,73	,340#9	,17#7	34,15	,341#9
7,49	,143#9	,86#6	,52	,309#9	10,80	,338#9	,16#7	34,16	,340#9
7,55	,152#9	,92#6	2,40	,312#9	10,88	,337#9	,16#7	34,25	,338#9
7,62	,156#9	,76#6	2,65	,316#9	10,97	,336#9	,16#7	34,38	,336#9
7,70	,160#9	,61#6	2,98	,319#9	11,03	,335#9	,16#7	34,35	,335#9
7,78	,166#9	,67#6	3,81	,323#9	11,11	,333#9	,16#7	34,38	,333#9
7,84	,169#9	,66#6	4,05	,325#9	11,18	,332#9	,16#7	34,47	,332#9
7,92	,178#9	,50#6	5,46	,328#9	11,25	,330#9	,16#7	34,43	,330#9
7,99	,199#9	,60#6	9,96	,331#9	11,33	,328#9	,15#7	34,35	,328#9
8,06	,227#9	,84#6	15,40	,334#9	11,40	,326#9	,15#7	34,34	,327#9
8,13	,253#9	,11#7	19,96	,336#9	11,48	,324#9	,15#7	34,26	,325#9
8,21	,278#9	,14#7	24,28	,338#9	11,53	,322#9	,15#7	34,18	,324#9
8,29	,300#9	,18#7	27,71	,340#9	11,61	,321#9	,14#7	34,20	,322#9
8,36	,312#9	,22#7	29,52	,342#9	11,66	,319#9	,13#7	34,01	,320#9
8,44	,318#9	,24#7	30,07	,344#9	11,75	,315#9	,12#7	33,69	,318#9
8,52	,321#9	,24#7	30,36	,346#9	11,81	,313#9	,13#7	33,57	,317#9
8,59	,325#9	,26#7	30,80	,347#9	11,88	,311#9	,14#7	33,57	,315#9
8,67	,327#9	,27#7	30,90	,349#9	11,96	,309#9	,14#7	33,63	,313#9
8,75	,329#9	,26#7	30,92	,350#9	12,03	,309#9	,14#7	33,96	,311#9
8,83	,332#9	,28#7	31,18	,351#9	12,10	,309#9	,15#7	34,35	,309#9
8,96	,336#9	,29#7	31,58	,353#9	12,17	,307#9	,15#7	34,54	,307#9
8,98	,337#9	,29#7	31,73	,353#9	12,24	,305#9	,13#7	34,49	,305#9
9,06	,338#9	,28#7	31,80	,353#9	12,30	,303#9	,13#7	34,25	,303#9
9.13	,339#9	,30#7	31,95	,354#9	12,38	,299#9	,13#7	33,80	,301#9
9,22	,340#9	,31#7	31,94	,354#9	12,45	,294#9	,13#7	33,03	,299#9
9,28	,338#9	,29#7	31,55	,355#9	12,52	,288#9	,12#7	31,72	,298#9
9,37	,332#9	,28#7	30,42	,355#9	12,59	,281#9	,12#7	30,51	,296#9
9,44	,317#9	,26#7	27,71	,355#9	12,64	,278#9	,12#7	29,88	,294#9
9,51	,300#9	,22#7	24,43	,355#9	12,72	,275#9	,10#7	29,67	,292#9
9,60	,287#9	,19#7	21,75	,354#9	12,79	,274#9	,98#6	29,74	,290#9
9,67	,275#9	,18#7	19,35	,354#9	12,85	,274#9	,10#7	30,23	,288#9
9,77	,269#9	,17#7	17,85	,354#9	12,92	,274#9	,10#7	30,80	,286#9
9,83	,273#9	,16#7	18,70	,353#9	13,00	,272#9	,98#6	30,78	,284#9

MAX TT(N) IS 34,54 AT 12,17

SPRBBT= 44,74 , SPECET= ,9762#-2 , SPIBBT= 26,00 , RAIBBT= 44,19

(Site 2)

N	L(N)	ET(N)
93	6.64	.592*8
94	6.70	.605*8
95	6.78	.634*8
96	6.84	.668*8
97	6.92	.757*8
98	6.98	.836*8
99	7.07	.920*8
100	7.12	.990*8
101	7.21	.108*9
102	7.27	.115*9
103	7.35	.123*9
104	7.42	.132*9
105	7.49	.143*9
106	7.55	.152*9
107	7.62	.156*9
108	7.70	.160*9
109	7.78	.166*9
110	7.84	.169*9
111	7.92	.178*9
112	7.99	.199*9
113	8.06	.227*9
114	8.13	.253*9
115	8.21	.278*9
116	8.29	.300*9
117	8.36	.312*9
118	8.44	.318*9
119	8.52	.321*9
120	8.59	.325*9
121	8.67	.327*9
122	8.75	.329*9
123	8.83	.332*9
124	8.96	.336*9
125	8.98	.337*9
126	9.06	.338*9
127	9.13	.339*9
128	9.22	.340*9
129	9.28	.338*9
130	9.37	.332*9
131	9.44	.317*9
132	9.51	.300*9
133	9.60	.287*9
134	9.67	.275*9
135	9.77	.269*9
136	9.83	.273*9
137	9.91	.284*9
138	9.98	.296*9
139	10.06	.310*9
140	10.13	.323*9
141	10.21	.333*9
142	10.29	.339*9
143	10.37	.341*9
144	10.46	.342*9
145	10.50	.341*9
146	10.58	.340*9
147	10.65	.340*9
148	10.73	.340*9
149	10.80	.338*9
150	10.88	.337*9
151	10.97	.336*9
152	11.03	.335*9
153	11.11	.333*9
154	11.19	.332*9
155	11.25	.330*9
156	11.33	.328*9
157	11.40	.326*9
158	11.48	.324*9
159	11.53	.322*9
160	11.61	.321*9
161	11.66	.319*9
162	11.75	.315*9
163	11.81	.313*9
164	11.88	.311*9
165	11.96	.309*9
166	12.03	.309*9
167	12.10	.309*9
168	12.17	.307*9
169	12.24	.305*9
170	12.30	.303*9
171	12.38	.299*9
172	12.45	.294*9
173	12.52	.288*9
174	12.59	.281*9
175	12.64	.278*9
176	12.72	.275*9
177	12.79	.274*9
178	12.85	.274*9
179	12.92	.274*9
180	13.00	.272*9
N	L(N)	ET(N)



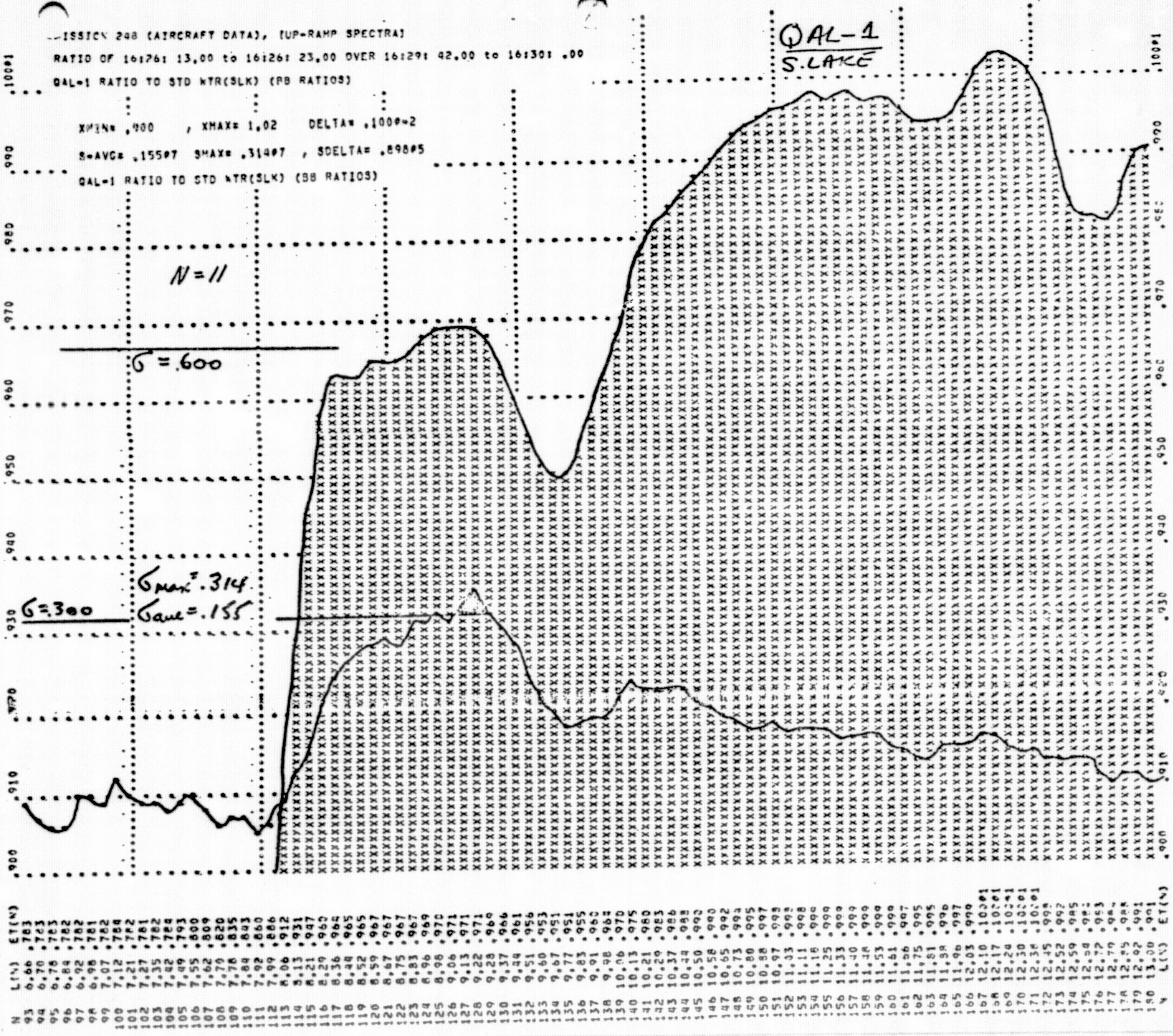


Figure 4.1.2.2 Ratio to water--Qal-1 (Site 2)

Table 4.1.3 Spectral data, emittance--Qal=2 (Site 3)

STANFORD REMOTE SENSING LABORATORIES

MISSION 248 (AIRCRAFT DATA), (UP-RAMP SPECTRA)

QAL=2

From 16:26: 23,00 to 16:26: 33,00

11 spectra averaged

L(N)	ET(N)	SDEV	TT(N)	BB(N)	L(N)	ET(N)	SDEV	TT(N)	BB(N)
6,66	,591#8	,75#6	-18,57	,251#9	9,91	,282#9	,37#7	20,69	,349#9
6,70	,607#8	,86#6	-18,54	,255#9	9,98	,294#9	,38#7	23,22	,348#9
6,78	,636#8	,10#7	-18,15	,260#9	10,06	,308#9	,40#7	26,08	,348#9
6,84	,669#8	,11#7	-17,53	,265#9	10,13	,321#9	,43#7	28,82	,347#9
6,92	,756#8	,93#6	-14,87	,271#9	10,21	,331#9	,44#7	30,90	,346#9
6,98	,835#8	,44#6	-12,43	,275#9	10,29	,336#9	,42#7	32,11	,345#9
7,07	,917#8	,38#6	-10,44	,280#9	10,37	,338#9	,41#7	32,73	,344#9
7,12	,985#8	,50#6	-8,75	,284#9	10,44	,339#9	,39#7	33,02	,343#9
7,21	,108#9	,92#6	-6,57	,290#9	10,50	,338#9	,38#7	33,10	,342#9
7,27	,115#9	,91#6	-5,12	,293#9	10,58	,338#9	,38#7	33,20	,341#9
7,35	,123#9	,86#6	-3,57	,298#9	10,65	,337#9	,38#7	33,42	,339#9
7,42	,132#9	,80#6	-1,65	,301#9	10,73	,337#9	,38#7	33,56	,338#9
7,49	,147#9	,80#6	,47	,305#9	10,80	,336#9	,39#7	33,58	,337#9
7,55	,151#9	,79#6	2,33	,308#9	10,88	,334#9	,39#7	33,65	,335#9
7,62	,155#9	,77#6	2,57	,312#9	10,97	,333#9	,39#7	33,74	,333#9
7,70	,159#9	,67#6	2,94	,315#9	11,03	,332#9	,38#7	33,71	,332#9
7,78	,165#9	,10#7	3,66	,319#9	11,11	,330#9	,38#7	33,73	,330#9
7,84	,168#9	,11#7	3,90	,321#9	11,18	,329#9	,37#7	33,80	,329#9
7,92	,177#9	,13#7	5,28	,324#9	11,25	,327#9	,36#7	33,79	,327#9
7,99	,198#9	,17#7	9,72	,327#9	11,33	,325#9	,36#7	33,71	,326#9
8,06	,226#9	,22#7	15,12	,330#9	11,40	,323#9	,35#7	33,69	,324#9
8,13	,251#9	,27#7	19,69	,332#9	11,48	,321#9	,34#7	33,62	,322#9
8,21	,276#9	,32#7	23,95	,334#9	11,53	,320#9	,33#7	33,54	,321#9
8,29	,298#9	,36#7	27,34	,336#9	11,61	,318#9	,33#7	33,58	,319#9
8,36	,310#9	,39#7	29,13	,338#9	11,66	,316#9	,31#7	33,43	,318#9
8,44	,315#9	,39#7	29,65	,340#9	11,75	,313#9	,30#7	33,12	,316#9
8,52	,319#9	,39#7	29,92	,342#9	11,81	,311#9	,29#7	33,03	,314#9
8,59	,323#9	,42#7	30,36	,343#9	11,88	,309#9	,29#7	33,02	,312#9
8,67	,325#9	,44#7	30,44	,345#9	11,96	,307#9	,28#7	33,05	,310#9
8,75	,326#9	,46#7	30,47	,346#9	12,03	,307#9	,29#7	33,36	,308#9
8,83	,329#9	,48#7	30,74	,347#9	12,10	,306#9	,30#7	33,74	,306#9
8,96	,333#9	,48#7	31,10	,349#9	12,17	,305#9	,31#7	33,90	,305#9
8,98	,334#9	,48#7	31,23	,349#9	12,24	,303#9	,31#7	33,86	,303#9
9,06	,335#9	,47#7	31,30	,350#9	12,30	,300#9	,30#7	33,63	,301#9
9,13	,336#9	,47#7	31,45	,350#9	12,38	,296#9	,29#7	33,17	,299#9
9,22	,337#9	,46#7	31,41	,351#9	12,45	,292#9	,27#7	32,42	,297#9
9,28	,335#9	,46#7	31,05	,351#9	12,52	,285#9	,24#7	31,15	,295#9
9,37	,329#9	,45#7	29,94	,351#9	12,59	,279#9	,23#7	29,96	,293#9
9,44	,315#9	,42#7	27,24	,351#9	12,64	,276#9	,22#7	29,36	,292#9
9,51	,298#9	,38#7	23,95	,351#9	12,72	,273#9	,21#7	29,17	,290#9
9,60	,285#9	,37#7	21,31	,351#9	12,79	,272#9	,21#7	29,25	,288#9
9,67	,273#9	,34#7	18,90	,351#9	12,85	,272#9	,22#7	29,69	,286#9
9,77	,267#9	,32#7	17,42	,350#9	12,92	,272#9	,21#7	30,20	,284#9
9,83	,271#9	,34#7	18,29	,350#9	13,00	,270#9	,21#7	30,20	,282#9

MAX TT(N) IS 33,90 AT 12,17

SPRBBT= 44,73 , SPEDET= ,9681#-2 , SPIBBT= 26,01 , RAIBBT= 44,17

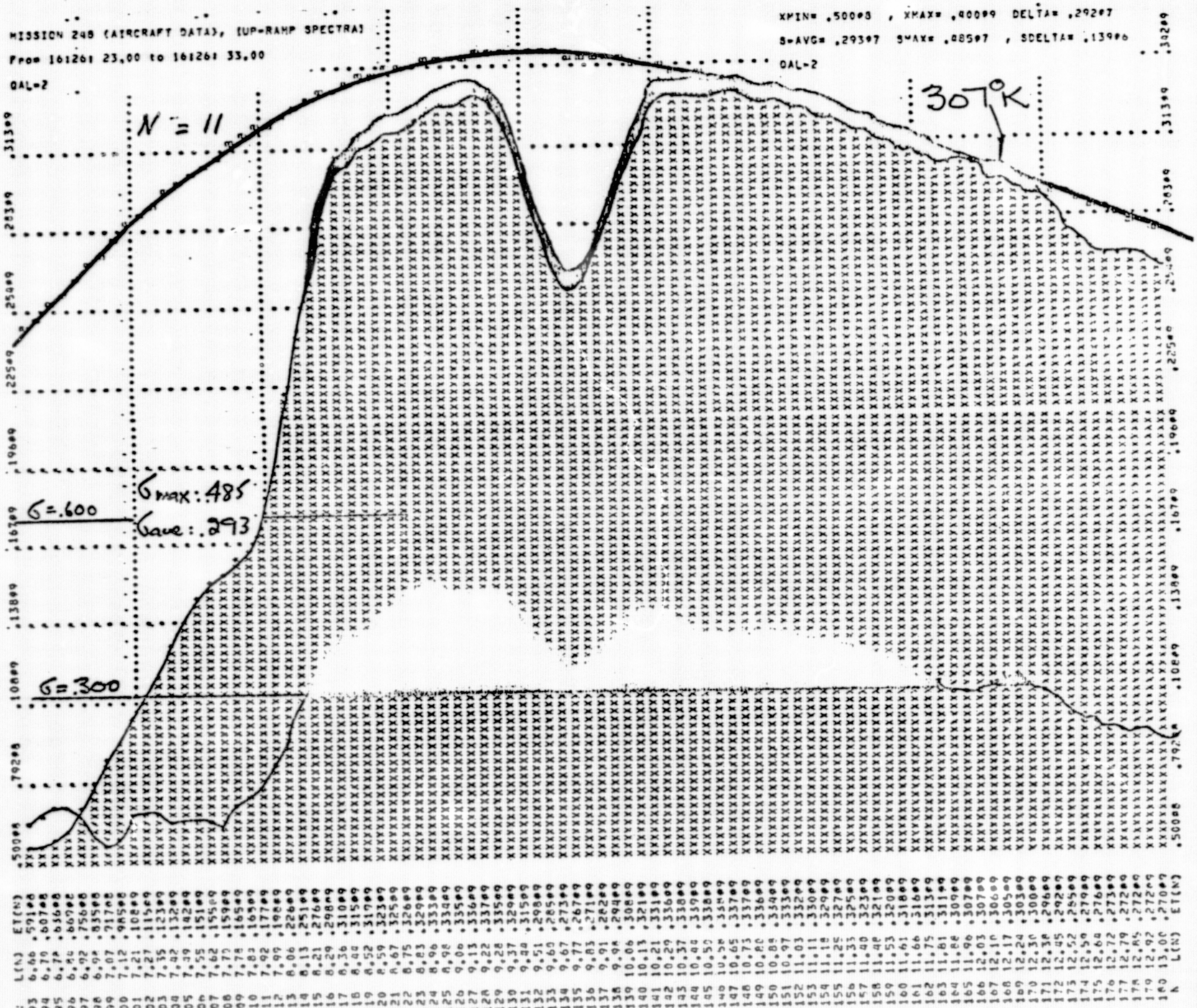


Figure 4.1.3.1 Targetemittance--Qal 2 (Site 3)

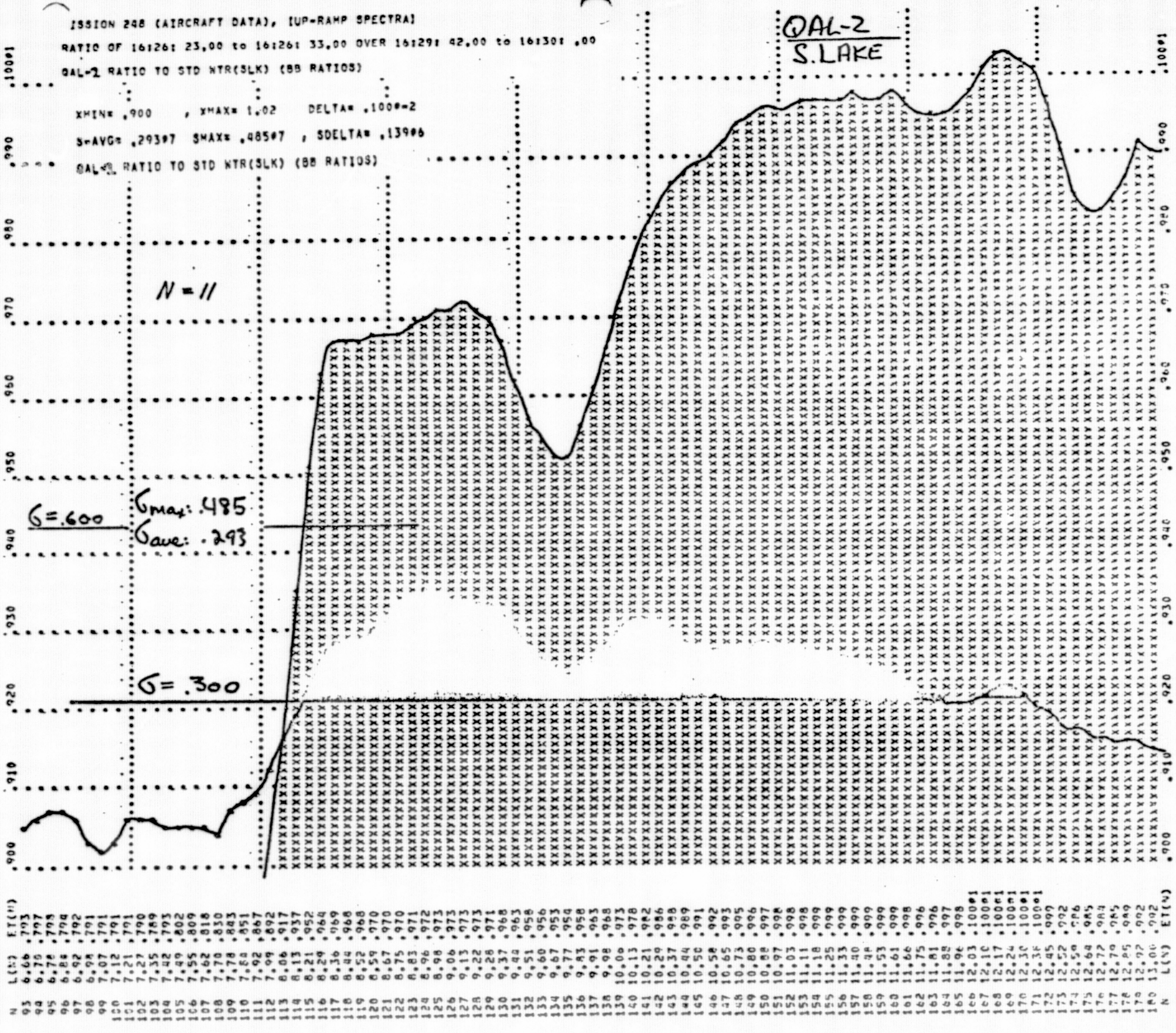


Figure 4.1.3.2 Target ratio --Qal 2 (Site 3)

Table 4.1.4 Spectral data, emittance--Qal-3 (Site 4)

STANFORD REMOTE SENSING LABORATORIES

MISSION 248 (AIRCRAFT DATA), [UP-RAMP SPECTRA]

QAL-3

From 16:26: 33,00 to 16:26: 43,00

11 spectra averaged

L(N)	ET(N)	SDEV	TT(N)	BB(N)
6,66	,588#8	,59#6	-18,74	,249#9
6,70	,603#8	,76#6	-18,72	,253#9
6,78	,634#8	,81#6	-18,25	,258#9
6,84	,667#8	,86#6	-17,59	,263#9
6,92	,752#8	,95#6	-15,01	,269#9
6,98	,830#8	,70#6	-12,63	,273#9
7,07	,914#8	,75#6	-10,54	,278#9
7,12	,982#8	,81#6	-8,84	,282#9
7,21	,108#9	,78#6	-6,61	,287#9
7,27	,115#9	,78#6	-5,13	,291#9
7,35	,123#9	,81#6	-3,56	,295#9
7,42	,132#9	,92#6	-1,72	,299#9
7,49	,142#9	,99#6	,42	,303#9
7,55	,151#9	,12#7	2,30	,306#9
7,62	,155#9	,11#7	2,58	,309#9
7,70	,159#9	,82#6	2,92	,313#9
7,78	,165#9	,83#6	3,73	,316#9
7,84	,168#9	,82#6	3,91	,319#9
7,92	,177#9	,99#6	5,24	,322#9
7,99	,198#9	,14#7	9,63	,325#9
8,06	,225#9	,20#7	14,96	,327#9
8,13	,250#9	,24#7	19,43	,329#9
8,21	,275#9	,27#7	23,68	,332#9
8,29	,296#9	,31#7	27,06	,334#9
8,36	,309#9	,33#7	28,86	,336#9
8,44	,314#9	,33#7	29,38	,338#9
8,52	,317#9	,33#7	29,69	,340#9
8,59	,321#9	,36#7	30,13	,341#9
8,67	,323#9	,35#7	30,22	,343#9
8,75	,325#9	,36#7	30,25	,344#9
8,83	,328#9	,37#7	30,53	,345#9
8,96	,332#9	,35#7	30,89	,347#9
8,98	,332#9	,37#7	31,00	,347#9
9,06	,334#9	,37#7	31,06	,348#9
9,13	,335#9	,38#7	31,18	,348#9
9,22	,335#9	,37#7	31,15	,348#9
9,29	,333#9	,35#7	30,77	,349#9
9,37	,328#9	,34#7	29,69	,349#9
9,44	,313#9	,31#7	26,98	,349#9
9,51	,297#9	,28#7	23,72	,349#9
9,60	,284#9	,25#7	21,07	,349#9
9,67	,272#9	,24#7	18,67	,349#9
9,77	,265#9	,24#7	17,15	,348#9
9,83	,270#9	,26#7	18,02	,348#9
9,91	,281#9	,27#7	20,39	,347#9
9,98	,293#9	,28#7	22,88	,347#9
10,06	,306#9	,29#7	25,71	,346#9
10,13	,319#9	,31#7	28,45	,345#9
10,21	,329#9	,32#7	30,51	,344#9
10,29	,334#9	,33#7	31,71	,343#9
10,37	,336#9	,33#7	32,33	,342#9
10,44	,337#9	,34#7	32,63	,341#9
10,50	,337#9	,33#7	32,73	,340#9
10,58	,336#9	,33#7	32,84	,339#9
10,65	,336#9	,33#7	33,07	,338#9
10,73	,335#9	,32#7	33,21	,336#9
10,80	,334#9	,32#7	33,23	,335#9
10,88	,333#9	,32#7	33,27	,333#9
10,97	,331#9	,31#7	33,34	,332#9
11,03	,330#9	,30#7	33,31	,330#9
11,11	,328#9	,30#7	33,33	,329#9
11,18	,327#9	,29#7	33,39	,327#9
11,25	,325#9	,30#7	33,38	,326#9
11,33	,324#9	,30#7	33,33	,324#9
11,40	,322#9	,31#7	33,31	,322#9
11,48	,320#9	,31#7	33,24	,321#9
11,53	,318#9	,30#7	33,19	,319#9
11,61	,316#9	,30#7	33,20	,317#9
11,66	,315#9	,29#7	33,04	,316#9
11,75	,311#9	,27#7	32,76	,314#9
11,81	,309#9	,26#7	32,67	,312#9
11,88	,307#9	,25#7	32,64	,311#9
11,96	,306#9	,24#7	32,71	,309#9
12,03	,305#9	,23#7	33,04	,307#9
12,10	,305#9	,22#7	33,39	,305#9
12,17	,304#9	,22#7	33,53	,303#9
12,24	,302#9	,22#7	33,52	,301#9
12,30	,299#9	,21#7	33,29	,300#9
12,38	,295#9	,21#7	32,81	,297#9
12,45	,291#9	,21#7	32,10	,296#9
12,52	,284#9	,20#7	30,87	,294#9
12,59	,279#9	,20#7	29,72	,292#9
12,64	,275#9	,19#7	29,13	,290#9
12,72	,273#9	,19#7	28,98	,288#9
12,79	,271#9	,19#7	29,07	,286#9
12,85	,271#9	,19#7	29,54	,285#9
12,92	,271#9	,18#7	30,05	,283#9
13,00	,269#9	,17#7	29,99	,281#9

MAX TT(N) IS 33,53 AT 12.17

SPRBBT= 44,75 , SPEDET= ,9728#-2 , SPIBBT= 26,00 , RAIBBT= 44,10

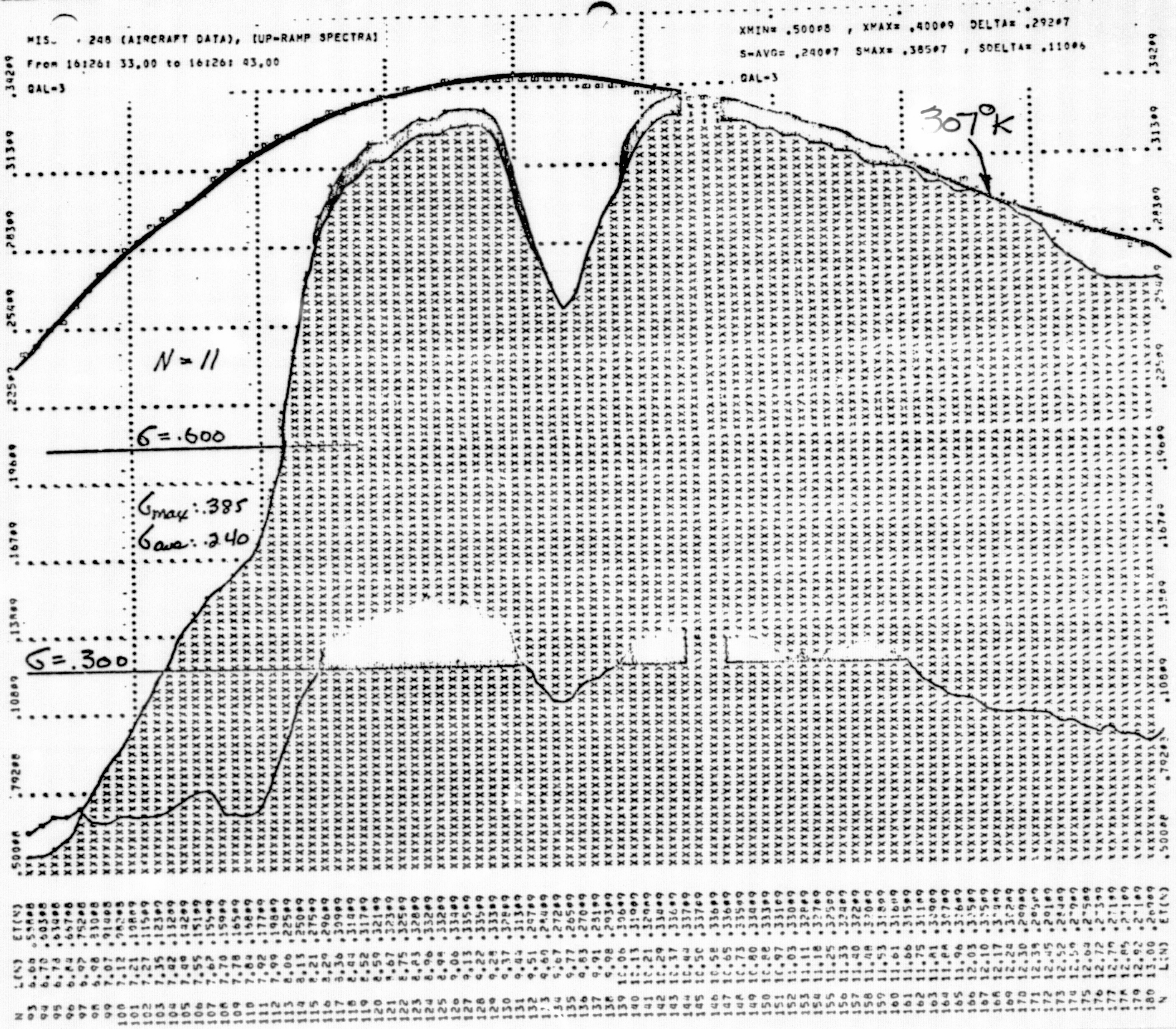


Figure 4.1.4.1 Target emittance—Qal 3 (Site 4)

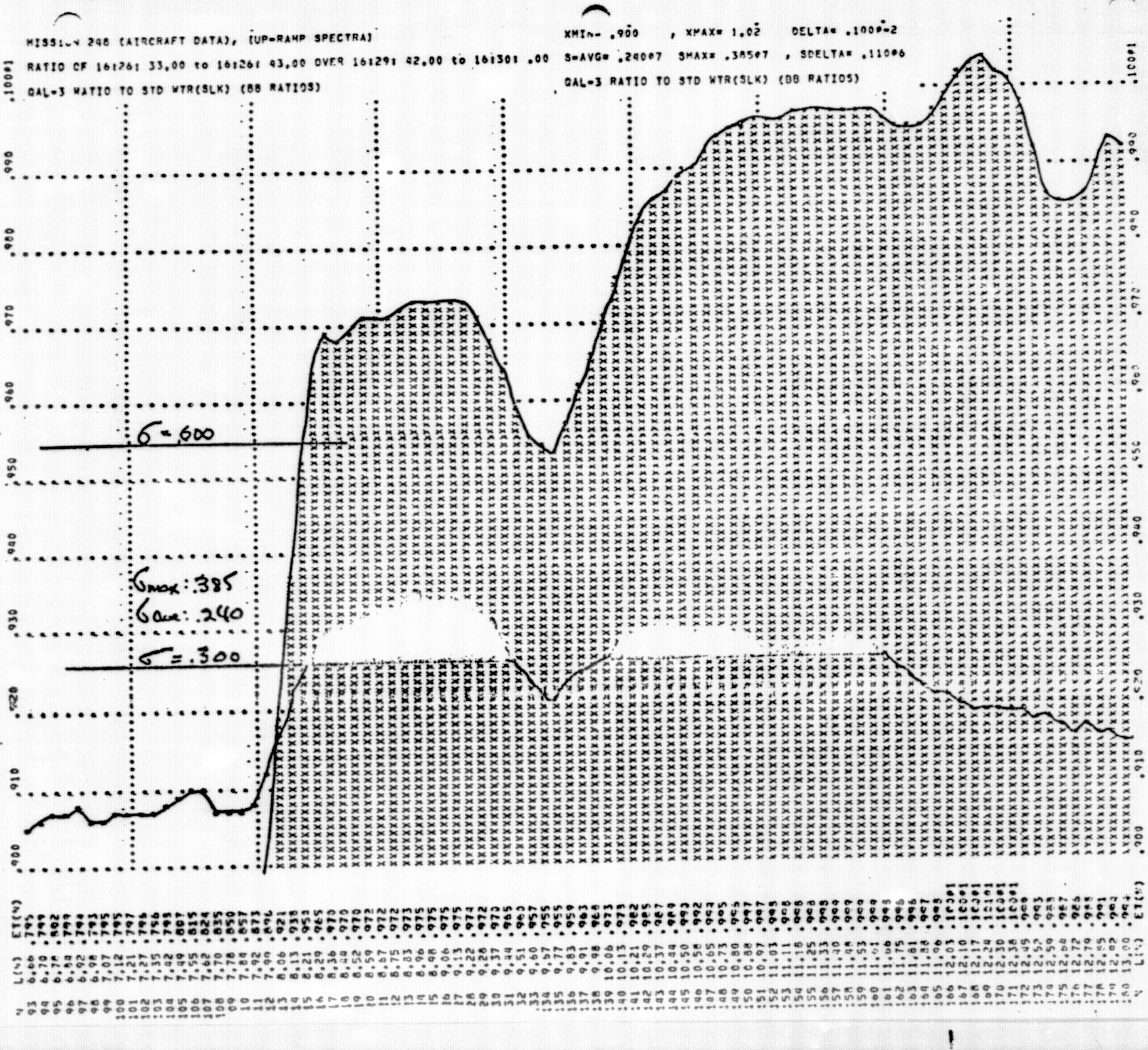


Figure 4.1.4.2 Target ratio--Qal 3 (Site 4)

5

Table 4.1.5 Spectral data, emittance--Ts (sediments) (Site 5)

13:14 THU 10 APR 75 Page 1 <EWBUDI>SRL.16

STANFORD REMOTE SENSING LABORATORIES

MISSION 249 (AIRCRAFT DATA), (UP-RAMP SPECTRA)

TS

From 16:26: 50.00 to 16:26: 56.00

7 spectra averaged

L(N)	ET(N)	SDEV	TT(N)	BB(N)	L(N)	ET(N)	SDEV	TT(N)	BB(N)
6.66	.597#8	.42#6	-18.69	.250#9	9.91	.281#9	.31#7	20.43	.348#9
6.70	.605#8	.50#6	-18.62	.253#9	9.98	.293#9	.33#7	22.97	.347#9
6.78	.634#8	.43#6	-18.25	.259#9	10.06	.307#9	.33#7	25.81	.347#9
6.84	.660#8	.43#6	-17.55	.263#9	10.13	.320#9	.35#7	28.60	.346#9
6.92	.757#8	.87#6	-14.02	.269#9	10.21	.330#9	.37#7	30.71	.345#9
6.98	.834#8	.91#6	-12.49	.273#9	10.29	.335#9	.38#7	31.91	.344#9
7.07	.913#8	.10#7	-10.59	.279#9	10.37	.337#9	.38#7	32.54	.343#9
7.12	.979#8	.87#6	-9.01	.283#9	10.44	.338#9	.39#7	32.85	.342#9
7.21	.107#9	.71#6	-6.89	.288#9	10.50	.338#9	.38#7	32.93	.341#9
7.27	.114#9	.62#6	-5.40	.292#9	10.58	.337#9	.38#7	33.03	.339#9
7.35	.122#9	.61#6	-3.79	.296#9	10.65	.337#9	.36#7	33.23	.338#9
7.42	.131#9	.49#6	-1.85	.300#9	10.73	.336#9	.36#7	33.37	.337#9
7.49	.142#9	.74#6	.32	.304#9	10.80	.335#9	.35#7	33.37	.336#9
7.55	.151#9	.65#6	2.23	.307#9	10.88	.333#9	.35#7	33.42	.334#9
7.62	.155#9	.75#6	2.45	.310#9	10.97	.332#9	.35#7	33.51	.332#9
7.70	.159#9	.95#6	2.84	.314#9	11.03	.331#9	.36#7	33.50	.331#9
7.78	.165#9	.13#7	3.67	.317#9	11.11	.329#9	.36#7	33.51	.329#9
7.84	.169#9	.11#7	3.92	.320#9	11.18	.328#9	.35#7	33.58	.328#9
7.92	.177#9	.12#7	5.29	.323#9	11.25	.326#9	.34#7	33.54	.326#9
7.99	.198#9	.14#7	9.72	.325#9	11.33	.324#9	.33#7	33.46	.325#9
8.06	.226#9	.17#7	15.11	.328#9	11.40	.322#9	.32#7	33.41	.323#9
8.13	.251#9	.23#7	19.60	.330#9	11.48	.320#9	.30#7	33.32	.321#9
8.21	.276#9	.28#7	23.90	.333#9	11.53	.318#9	.31#7	33.26	.320#9
8.29	.298#9	.32#7	27.34	.335#9	11.61	.317#9	.31#7	33.28	.318#9
8.36	.311#9	.34#7	29.19	.337#9	11.66	.315#9	.30#7	33.13	.317#9
8.44	.316#9	.35#7	29.73	.339#9	11.75	.312#9	.30#7	32.86	.315#9
8.52	.317#9	.34#7	30.04	.341#9	11.81	.309#9	.30#7	32.73	.313#9
8.59	.323#9	.34#7	30.45	.342#9	11.88	.308#9	.28#7	32.70	.311#9
8.67	.325#9	.35#7	30.50	.343#9	11.96	.306#9	.27#7	32.76	.309#9
8.75	.326#9	.36#7	30.48	.345#9	12.03	.306#9	.27#7	33.09	.308#9
8.83	.329#9	.37#7	30.74	.346#9	12.10	.305#9	.28#7	33.45	.306#9
8.90	.333#9	.38#7	31.07	.347#9	12.17	.304#9	.29#7	33.67	.304#9
8.98	.334#9	.41#7	31.20	.348#9	12.24	.302#9	.29#7	33.66	.302#9
9.06	.335#9	.41#7	31.28	.349#9	12.30	.300#9	.28#7	33.43	.300#9
9.13	.336#9	.41#7	31.44	.349#9	12.38	.296#9	.27#7	32.94	.298#9
9.22	.337#9	.41#7	31.42	.349#9	12.45	.291#9	.26#7	32.22	.296#9
9.28	.335#9	.41#7	31.07	.350#9	12.52	.285#9	.23#7	30.97	.294#9
9.37	.329#9	.39#7	29.94	.350#9	12.59	.279#9	.23#7	29.84	.292#9
9.44	.315#9	.35#7	27.20	.350#9	12.64	.275#9	.22#7	29.25	.291#9
9.51	.297#9	.34#7	23.83	.350#9	12.72	.273#9	.22#7	29.09	.289#9
9.60	.284#9	.32#7	21.10	.350#9	12.79	.272#9	.21#7	29.16	.287#9
9.67	.272#9	.31#7	18.66	.349#9	12.85	.271#9	.22#7	29.63	.285#9
9.77	.265#9	.30#7	17.14	.349#9	12.92	.271#9	.22#7	30.14	.283#9
9.83	.269#9	.31#7	17.90	.348#9	13.00	.269#9	.21#7	30.12	.281#9

MAX TT(N) IS 33.67 AT 12.17

SPREBT= 41.74 , SPEDET= .9786#-2 , SPISBT= 26.00 , RAISBT= 44.03

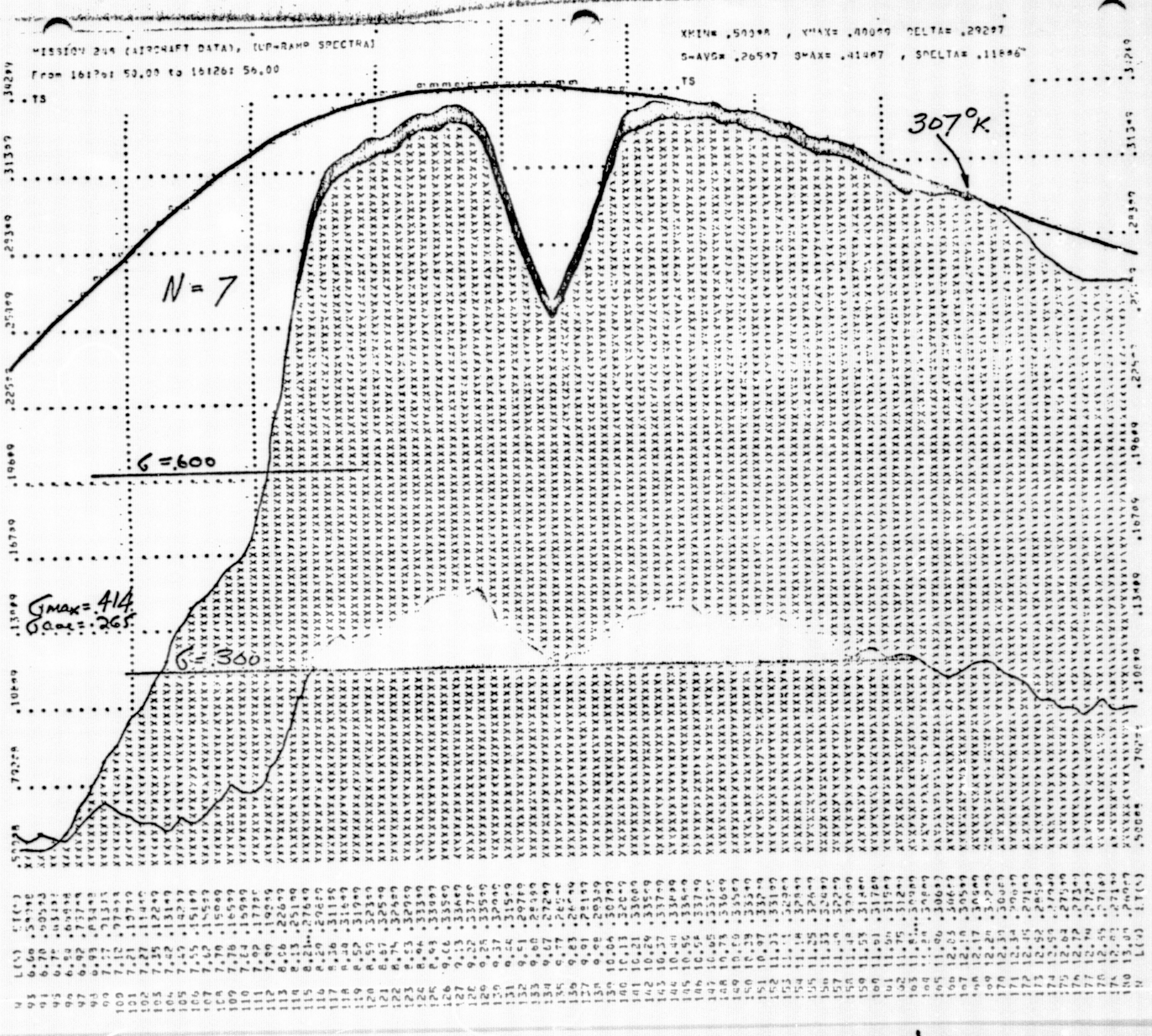


Figure 4.1.5.1 Target emittance--Ts (Site 5)

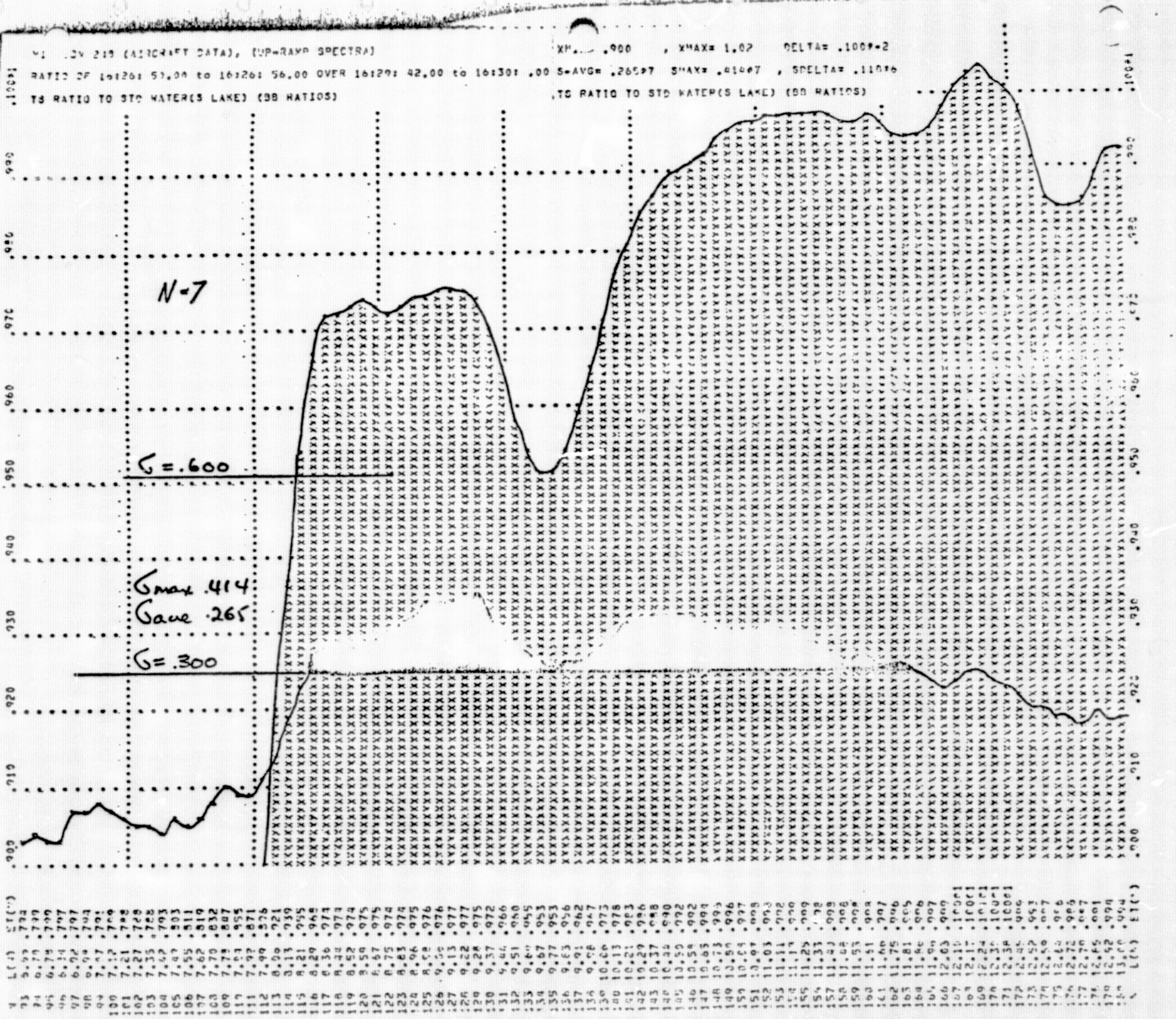


Figure 4.1.5.2 Target ratio--Ts (Site 5)

Table 4.1.6 Spectral data, emittance--JTrV (metavolcanics) (Site 6)

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STANFORD REMOTE SENSING LABORATORIES

MISSION 248 (AIRCRAFT DATA), (UP-RAMP SPECTRA)

JTRV Metavolcanics

From 16:27: 47,00 to 16:27: 54,00

8 spectra averaged

L(N)	ET(N)	SDEV	TT(N)	BB(N)	L(N)	ET(N)	SDEV	TT(N)	BB(N)
6,66	,580*8	,95*6	-19,16	,250*9	9,91	,230*9	.52*7	20,31	,348*9
6,70	,594*8	,11*7	-19,18	,253*9	9,90	,292*9	.56*7	22,84	,347*9
6,78	,626*8	,13*7	-18,64	,259*9	10,06	,306*9	.60*7	25,71	,346*9
6,84	,662*8	,13*7	-17,83	,263*9	10,13	,317*9	.63*7	28,45	,346*9
6,92	,753*8	,12*7	-15,00	,269*9	10,21	,329*9	,64*7	30,53	,345*9
6,98	,832*8	,12*7	-12,56	,273*9	10,29	,335*9	,65*7	31,75	,344*9
7,07	,916*8	,13*7	-10,47	,279*9	10,37	,337*9	,66*7	32,38	,343*9
7,12	,984*8	,13*7	-8,77	,282*9	10,44	,337*9	,66*7	32,66	,342*9
7,21	,108*9	,12*7	-6,60	,288*9	10,50	,337*9	,65*7	32,77	,341*9
7,27	,115*9	,91*6	-5,09	,292*9	10,58	,336*9	,65*7	32,88	,339*9
7,35	,123*9	,58*6	-3,42	,296*9	10,65	,336*9	,63*7	33,09	,338*9
7,42	,133*9	,59*6	-1,40	,300*9	10,73	,335*9	,61*7	33,23	,337*9
7,49	,144*9	,74*6	,91	,304*9	10,80	,334*9	,60*7	33,27	,335*9
7,55	,154*9	,11*7	2,89	,306*9	10,88	,333*9	,58*7	33,31	,334*9
7,62	,158*9	,13*7	3,19	,310*9	10,97	,332*9	,56*7	33,40	,332*9
7,70	,162*9	,16*7	3,57	,314*9	11,03	,330*9	,55*7	33,39	,331*9
7,78	,168*9	,16*7	4,37	,317*9	11,11	,329*9	,54*7	33,42	,329*9
7,84	,171*9	,18*7	4,58	,320*9	11,18	,327*9	,54*7	33,48	,328*9
7,92	,180*9	,22*7	5,94	,323*9	11,25	,326*9	,53*7	33,48	,326*9
7,99	,201*9	,28*7	10,32	,325*9	11,33	,324*9	,53*7	33,42	,324*9
8,06	,228*9	,39*7	15,61	,328*9	11,40	,322*9	,53*7	33,39	,323*9
8,13	,253*9	,52*7	20,03	,330*9	11,48	,320*9	,52*7	33,31	,321*9
8,21	,278*9	,62*7	24,21	,333*9	11,53	,318*9	,50*7	33,24	,320*9
8,29	,299*9	,73*7	27,49	,335*9	11,61	,317*9	,49*7	33,26	,318*9
8,36	,311*9	,82*7	29,22	,337*9	11,66	,315*9	,46*7	33,11	,317*9
8,44	,316*9	,84*7	29,70	,339*9	11,75	,312*9	,45*7	32,84	,315*9
8,52	,319*9	,86*7	29,96	,340*9	11,81	,310*9	,45*7	32,76	,313*9
8,59	,323*9	,87*7	30,35	,342*9	11,88	,308*9	,44*7	32,77	,311*9
8,67	,325*9	,86*7	30,46	,343*9	11,96	,306*9	,44*7	32,86	,309*9
8,75	,327*9	,87*7	30,51	,344*9	12,03	,306*9	,45*7	33,17	,307*9
8,83	,330*9	,89*7	30,81	,346*9	12,10	,305*9	,45*7	33,49	,305*9
8,96	,333*9	,90*7	31,17	,347*9	12,17	,304*9	,43*7	33,63	,304*9
8,98	,334*9	,91*7	31,29	,347*9	12,24	,302*9	,43*7	33,58	,302*9
9,06	,335*9	,91*7	31,35	,348*9	12,30	,299*9	,41*7	33,36	,300*9
9,13	,337*9	,91*7	31,47	,349*9	12,38	,296*9	,40*7	32,92	,298*9
9,22	,337*9	,89*7	31,42	,349*9	12,45	,291*9	,38*7	32,25	,296*9
9,28	,335*9	,84*7	31,04	,349*9	12,52	,285*9	,36*7	31,07	,294*9
9,37	,329*9	,79*7	29,93	,350*9	12,59	,279*9	,34*7	29,97	,292*9
9,44	,315*9	,71*7	27,19	,350*9	12,64	,276*9	,34*7	29,37	,291*9
9,51	,297*9	,60*7	23,84	,350*9	12,72	,273*9	,35*7	29,19	,289*9
9,60	,287*9	,53*7	21,09	,349*9	12,79	,272*9	,36*7	29,28	,287*9
9,67	,272*9	,48*7	18,60	,349*9	12,85	,272*9	,37*7	29,75	,285*9
9,77	,265*9	,46*7	17,07	,349*9	12,92	,272*9	,40*7	30,28	,283*9
9,83	,267*9	,48*7	17,91	,348*9	13,00	,270*9	,41*7	30,29	,281*9

MAX TT(N) IS 33,63 AT 12.17

SPRBBT= 44,76 , SPEDET= ,9683*-2 , SPIBBT= 25,95 , RAIBBT= 43,78

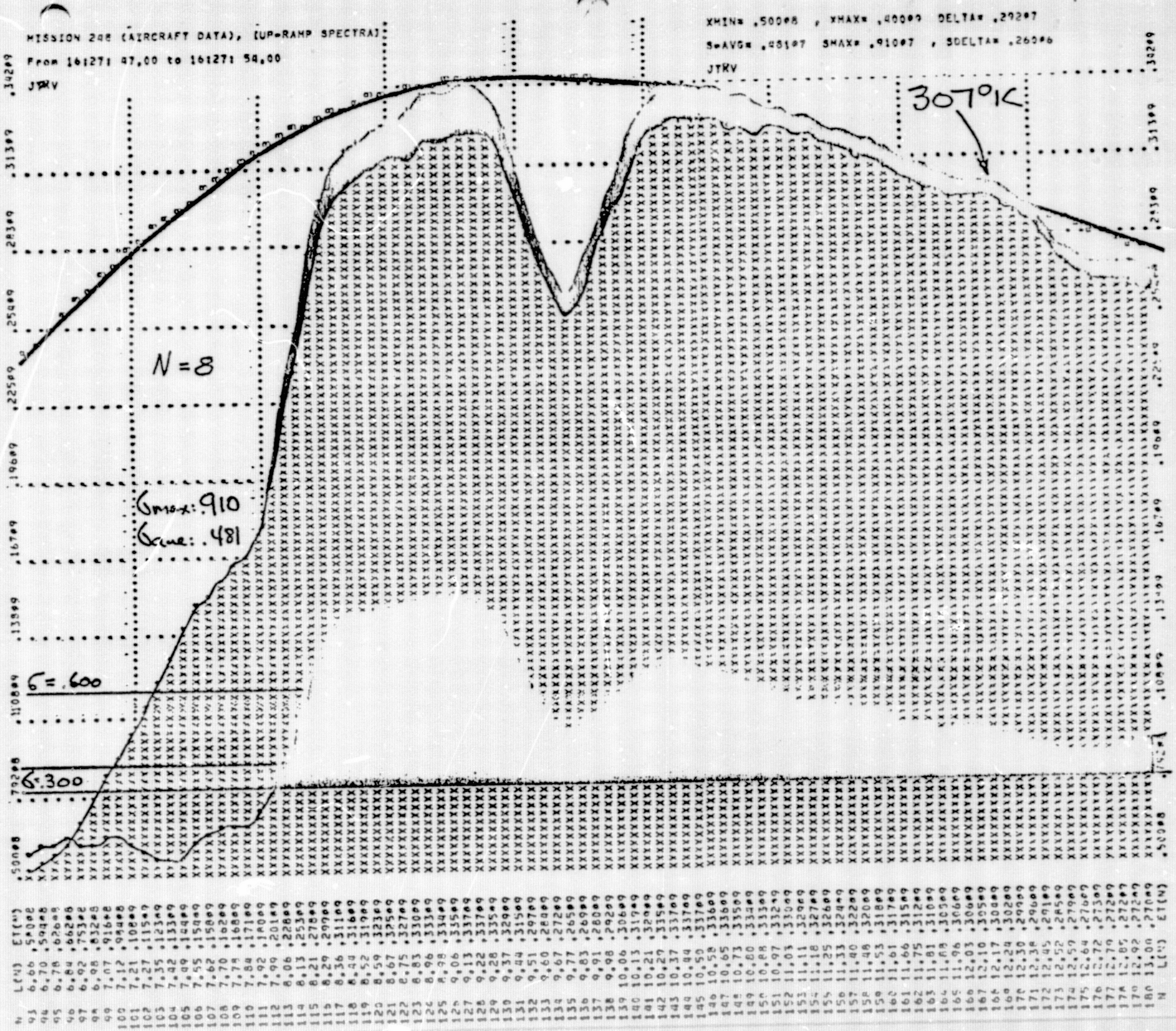

Figure 4.1.6.1Target emittance--JTrV (Site 6)

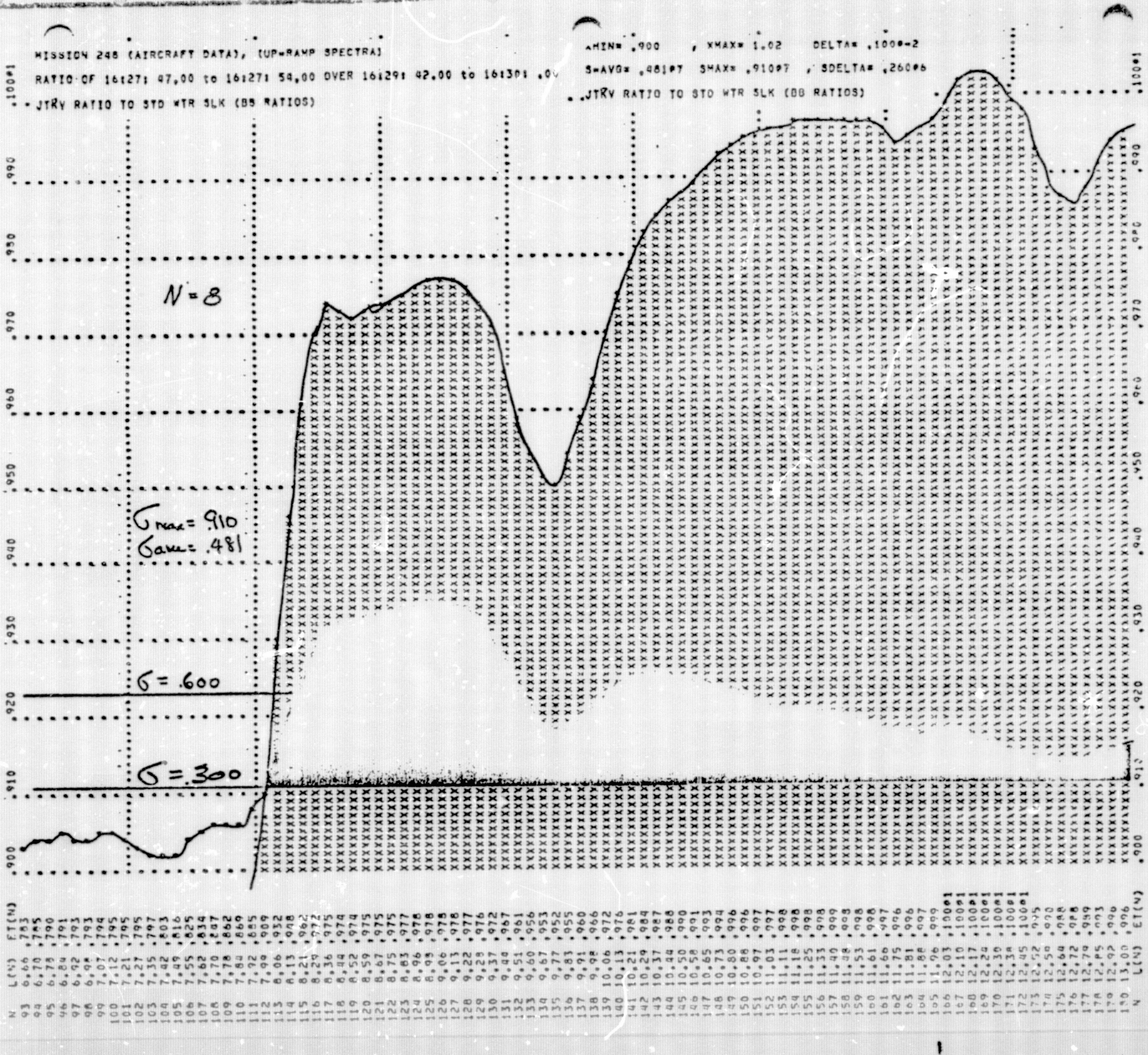

Figure 4.1.6.2 Target ratio--JTrV (Site 6)

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Table 4.1.7 Spectral data, emittance--Qal-low temp (Site 7a)

14:19 WED 16 APR 75 Page 1 <EWBUDI>SL.17

STANFORD REMOTE SENSING LABORATORIES

MISSION 248 (AIRCRAFT DATA), (UP-RAMP SPECTRA)

QAL LOW TEMP

From 16:28: 11,00 to 16:28: 20,00

10 spectra averaged

L(N)	ET(N)	SDEV	TT(N)	BB(N)	L(N)	ET(N)	SDEV	TT(N)	BB(N)
6,66	,580#8	,41#6	-19,17	,221#9	9,91	,260#9	,22#7	15,93	,320#9
6,70	,594#8	,48#6	-19,19	,224#9	9,98	,271#9	,23#7	18,26	,320#9
6,78	,622#8	,73#6	-18,83	,230#9	10,06	,283#9	,24#7	20,89	,319#9
6,84	,659#8	,88#6	-17,97	,234#9	10,13	,295#9	,24#7	23,45	,319#9
6,92	,748#8	,78#6	-15,21	,239#9	10,21	,304#9	,24#7	25,39	,318#9
6,98	,823#8	,81#6	-12,92	,243#9	10,29	,309#9	,25#7	26,52	,317#9
7,07	,905#8	,81#6	-10,88	,248#9	10,37	,311#9	,24#7	27,12	,316#9
7,12	,976#8	,91#6	-9,06	,252#9	10,44	,311#9	,24#7	27,40	,316#9
7,21	,107#9	,93#6	-6,93	,257#9	10,50	,311#9	,25#7	27,50	,315#9
7,27	,114#9	,96#6	-5,50	,261#9	10,58	,311#9	,25#7	27,60	,314#9
7,35	,122#9	,76#6	-3,79	,265#9	10,65	,310#9	,26#7	27,78	,313#9
7,42	,131#9	,79#6	-1,88	,268#9	10,73	,310#9	,26#7	27,87	,312#9
7,49	,141#9	,73#6	,14	,272#9	10,80	,309#9	,26#7	27,87	,311#9
7,55	,150#9	,67#6	2,05	,275#9	10,88	,308#9	,25#7	27,92	,310#9
7,62	,154#9	,60#6	2,29	,279#9	10,97	,307#9	,25#7	28,00	,308#9
7,70	,158#9	,59#6	2,44	,282#9	11,03	,306#9	,25#7	27,99	,307#9
7,78	,162#9	,69#6	2,99	,285#9	11,11	,304#9	,24#7	28,03	,306#9
7,84	,165#9	,97#6	3,08	,288#9	11,18	,304#9	,23#7	28,10	,304#9
7,92	,172#9	,11#7	4,06	,291#9	11,25	,302#9	,22#7	28,11	,303#9
7,99	,190#9	,13#7	7,85	,294#9	11,33	,301#9	,22#7	28,09	,302#9
8,06	,214#9	,16#7	12,51	,296#9	11,40	,299#9	,22#7	28,06	,300#9
8,13	,235#9	,18#7	16,43	,299#9	11,48	,297#9	,22#7	28,02	,299#9
8,21	,256#9	,19#7	20,16	,301#9	11,53	,296#9	,21#7	27,99	,298#9
8,29	,274#9	,21#7	23,08	,304#9	11,61	,295#9	,22#7	28,01	,296#9
8,36	,285#9	,24#7	24,64	,305#9	11,66	,293#9	,21#7	27,89	,295#9
8,44	,289#9	,24#7	25,11	,307#9	11,75	,291#9	,21#7	27,72	,293#9
8,52	,292#9	,23#7	25,31	,309#9	11,81	,289#9	,22#7	27,65	,292#9
8,59	,296#9	,24#7	25,64	,311#9	11,88	,288#9	,22#7	27,67	,290#9
8,67	,298#9	,25#7	25,70	,312#9	11,96	,286#9	,22#7	27,73	,288#9
8,75	,299#9	,26#7	25,69	,314#9	12,03	,286#9	,21#7	27,98	,287#9
8,83	,302#9	,27#7	25,89	,315#9	12,10	,285#9	,20#7	28,27	,285#9
8,96	,305#9	,28#7	26,16	,317#9	12,17	,284#9	,20#7	28,41	,284#9
8,98	,306#9	,27#7	26,23	,317#9	12,24	,282#9	,20#7	28,40	,282#9
9,06	,307#9	,27#7	26,26	,318#9	12,30	,280#9	,19#7	28,28	,280#9
9,13	,308#9	,27#7	26,32	,319#9	12,38	,277#9	,19#7	27,96	,279#9
9,22	,308#9	,27#7	26,22	,319#9	12,45	,274#9	,18#7	27,44	,277#9
9,28	,307#9	,27#7	25,85	,320#9	12,52	,269#9	,16#7	26,52	,275#9
9,37	,302#9	,27#7	24,79	,320#9	12,59	,264#9	,16#7	25,64	,274#9
9,44	,289#9	,25#7	22,23	,321#9	12,64	,261#9	,15#7	25,12	,272#9
9,51	,274#9	,23#7	19,16	,321#9	12,72	,259#9	,15#7	24,96	,270#9
9,60	,262#9	,22#7	16,67	,321#9	12,79	,258#9	,15#7	25,01	,269#9
9,67	,252#9	,21#7	14,40	,321#9	12,85	,257#9	,14#7	25,33	,267#9
9,77	,246#9	,21#7	12,97	,321#9	12,92	,257#9	,13#7	25,74	,265#9
9,83	,250#9	,22#7	13,72	,320#9	13,00	,255#9	,13#7	25,73	,264#9

MAX TT(N) IS 28,41 AT 12,17

SPRBBT= 44,78 , SPEDET= ,9731#-2 , SPIBBT= 25,92 , RAIBBT= 43,70

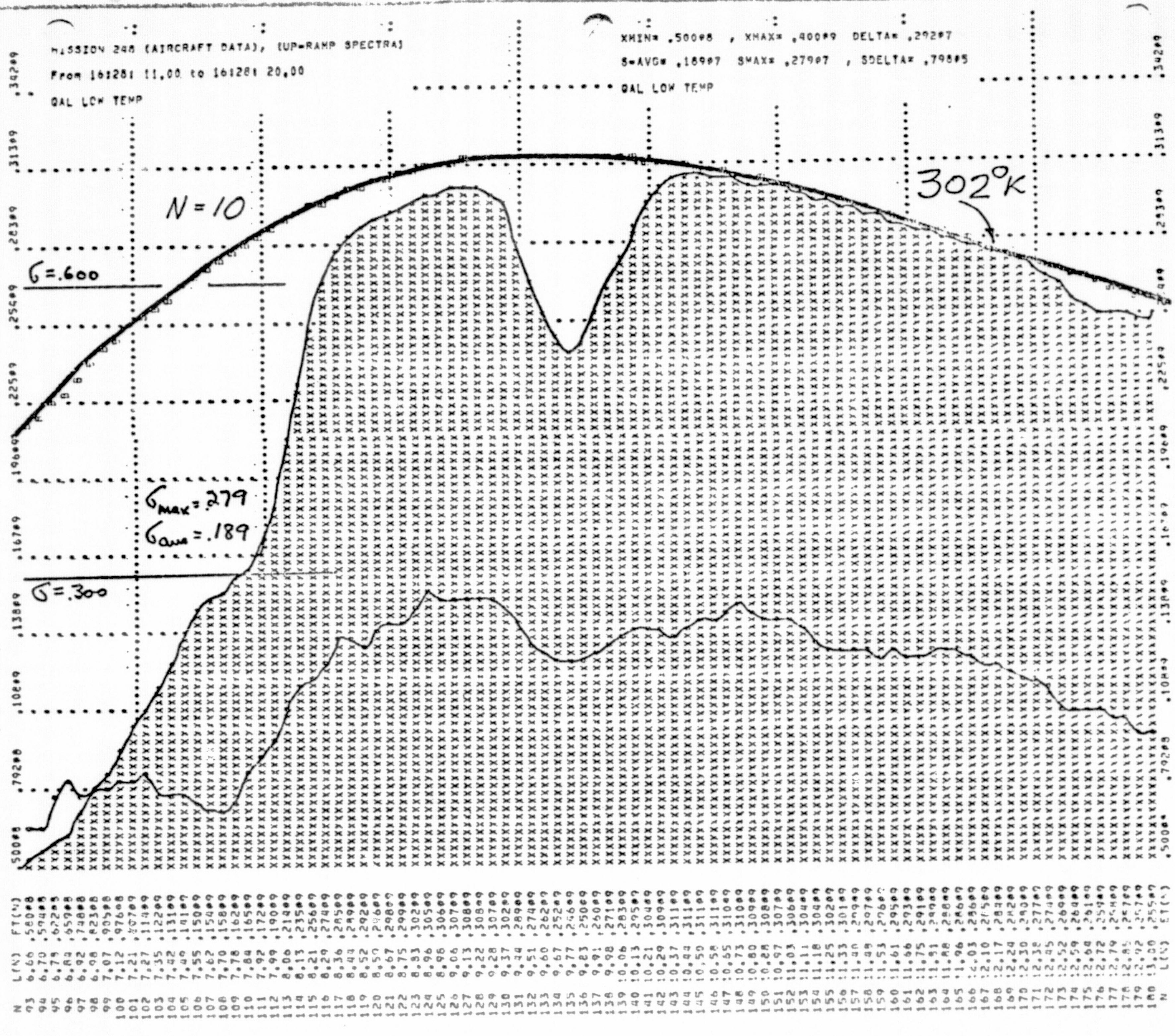


Figure 4.1.7.1 Target emittance—Qal-low temp (Site 7a)

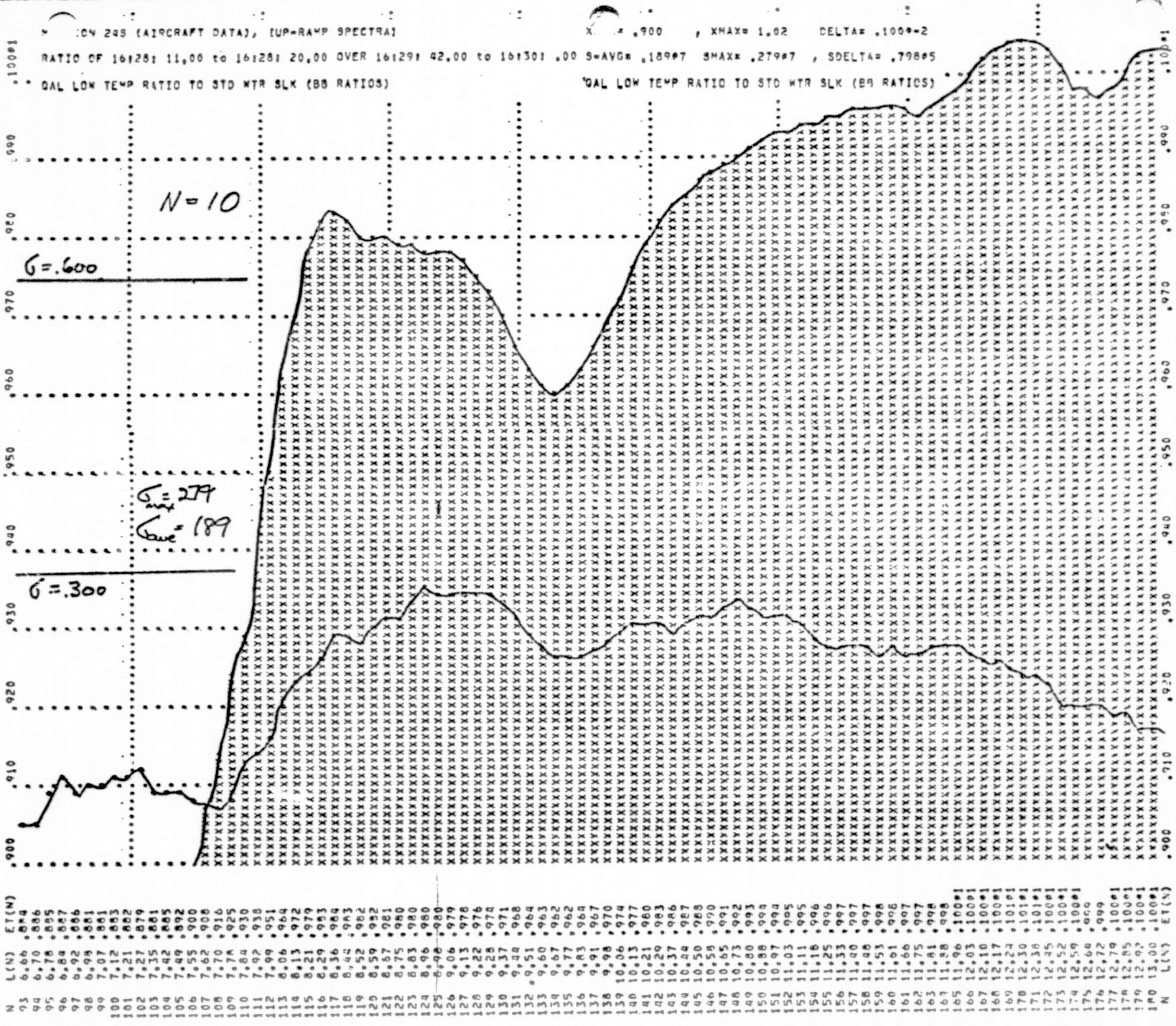


Figure 4.1.7.2 Target ratio—Qal-low temp (Site 7a)

Table 4.1.8 Spectral data, emittance--Tre (Excelsior volcanics) (Site 7b)

STANFORD REMOTE SENSING LABORATORIES

MISSION 248 (AIRCRAFT DATA). [UP-RAMP SPECTRA]

TRE Excelsior Volcanics

From 16:28: 41.00 to 16:28: 48.00

8 spectra averaged

L(N)	ET(N)	SDEV	TT(N)	BB(N)	L(N)	ET(N)	SDEV	TT(N)	BB(N)
6.66	.577@8	.51@6	-19.31	.250@7	9.91	.204@9	.83@7	21.03	.347@9
6.70	.591@8	.74@6	-19.35	.253@7	9.98	.296@9	.80@7	23.52	.347@9
6.78	.620@8	.94@6	-18.93	.259@7	10.06	.309@9	.94@7	26.36	.346@9
6.84	.659@8	.98@6	-17.98	.263@7	10.13	.323@9	.10@8	29.09	.345@9
6.92	.751@8	.11@7	-15.08	.269@7	10.21	.332@9	.10@8	31.14	.344@9
6.98	.831@8	.10@7	-12.59	.273@7	10.29	.338@9	.11@8	32.35	.343@9
7.07	.914@8	.10@7	-10.55	.279@7	10.37	.339@9	.11@8	32.92	.342@9
7.12	.985@8	.84@6	-8.75	.282@7	10.44	.340@9	.11@8	33.15	.341@9
7.21	.108@9	.85@6	-6.60	.288@7	10.50	.339@9	.11@8	33.19	.340@9
7.27	.115@9	.11@7	-5.11	.271@7	10.58	.338@9	.10@8	33.27	.337@9
7.35	.124@9	.85@6	-3.36	.296@7	10.65	.338@9	.10@8	33.42	.338@9
7.42	.133@9	.89@6	-1.27	.279@7	10.73	.337@9	.10@8	33.51	.337@9
7.49	.144@9	.14@7	1.04	.303@7	10.80	.335@9	.10@8	33.50	.335@9
7.55	.154@9	.18@7	3.08	.306@7	10.88	.334@9	.10@8	33.55	.334@9
7.62	.159@9	.22@7	3.43	.310@7	10.97	.332@9	.10@8	33.57	.332@9
7.70	.163@9	.26@7	3.85	.313@7	11.03	.331@9	.99@7	33.52	.331@9
7.78	.169@9	.31@7	4.67	.317@7	11.11	.329@9	.98@7	33.54	.327@9
7.84	.172@9	.32@7	4.88	.319@7	11.18	.328@9	.97@7	33.60	.328@9
7.92	.181@9	.38@7	6.21	.323@7	11.25	.326@9	.96@7	33.56	.326@9
7.99	.202@9	.49@7	10.60	.325@7	11.33	.324@9	.94@7	33.49	.324@9
8.06	.229@9	.65@7	15.83	.328@7	11.40	.322@9	.93@7	33.46	.323@9
8.13	.254@9	.79@7	20.21	.330@7	11.48	.320@9	.91@7	33.38	.321@9
8.21	.279@9	.94@7	24.43	.332@7	11.53	.319@9	.90@7	33.30	.320@9
8.29	.301@9	.11@8	27.79	.335@7	11.61	.317@9	.87@7	33.31	.319@7
8.36	.313@9	.11@8	29.61	.337@7	11.66	.315@9	.87@7	33.17	.316@9
8.44	.319@9	.11@8	30.22	.338@7	11.75	.312@9	.84@7	32.91	.314@9
8.52	.323@9	.12@8	30.61	.340@7	11.81	.310@9	.83@7	32.80	.313@9
8.59	.327@9	.12@8	31.09	.342@7	11.88	.308@9	.82@7	32.81	.311@9
8.67	.329@9	.12@8	31.22	.343@7	11.96	.306@9	.80@7	32.85	.307@9
8.75	.331@9	.12@8	31.27	.344@7	12.03	.306@9	.80@7	33.13	.307@9
8.83	.334@9	.12@8	31.55	.345@7	12.10	.305@9	.80@7	33.46	.305@9
8.96	.337@9	.12@8	31.89	.347@7	12.17	.304@9	.79@7	33.58	.303@9
8.98	.338@9	.12@8	31.98	.347@9	12.24	.302@9	.78@7	33.52	.302@9
9.06	.337@9	.12@8	32.03	.348@7	12.30	.299@9	.76@7	33.32	.300@9
9.13	.340@9	.12@8	32.13	.348@7	12.38	.295@9	.74@7	32.90	.278@9
9.22	.341@9	.12@8	32.08	.349@9	12.45	.291@9	.71@7	32.20	.296@9
9.28	.339@9	.12@8	31.73	.349@7	12.52	.285@9	.68@7	31.03	.294@9
9.37	.333@9	.11@8	30.66	.349@7	12.59	.280@9	.64@7	29.97	.292@9
9.44	.319@9	.10@8	27.93	.349@7	12.64	.276@9	.61@7	29.38	.291@9
9.51	.301@9	.96@7	24.62	.347@7	12.72	.273@9	.59@7	29.21	.288@9
9.60	.288@9	.88@7	21.92	.349@7	12.79	.272@9	.59@7	29.30	.287@9
9.67	.276@9	.82@7	19.42	.349@7	12.85	.272@9	.60@7	29.78	.285@9
9.77	.269@9	.77@7	17.84	.348@7	12.92	.272@9	.61@7	30.29	.283@9
9.83	.273@9	.79@7	18.68	.348@9	13.00	.270@9	.63@7	30.30	.281@9

MAX TT(N) IS 33.60 AT 11.18

SPRBBT= 44.81 , SPEDET= .9784@-2 , SPIBBT= 25.91 , RAIBBT= 43.59

ORIGINAL PAGE IS OF POOR QUALITY

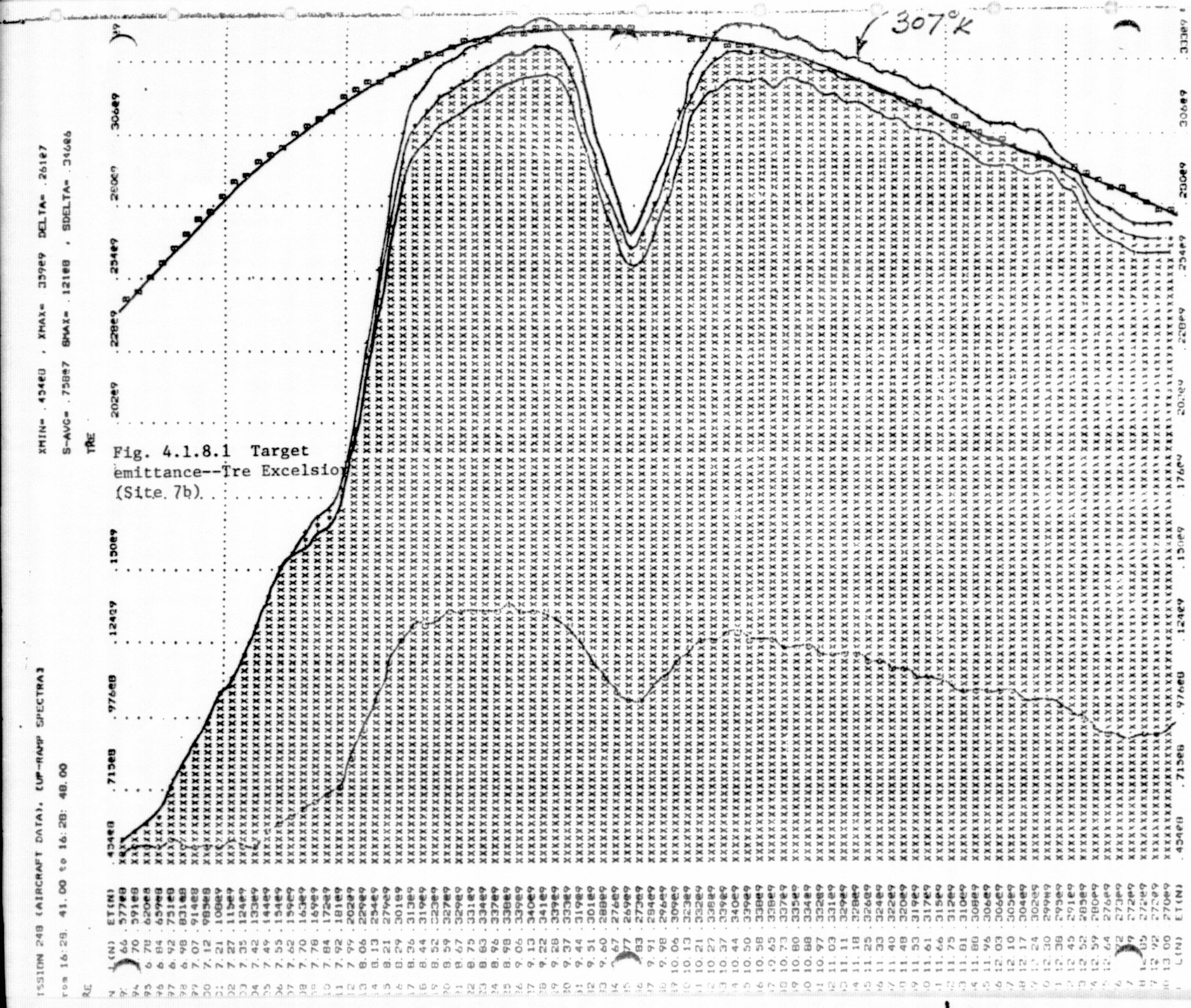


Fig. 4.1.8.1 Target emittance--Tre Excelsior (Site 7b)

Figure 4.1.8.2 Target ratio--Tre Excelsior (Site 7b)

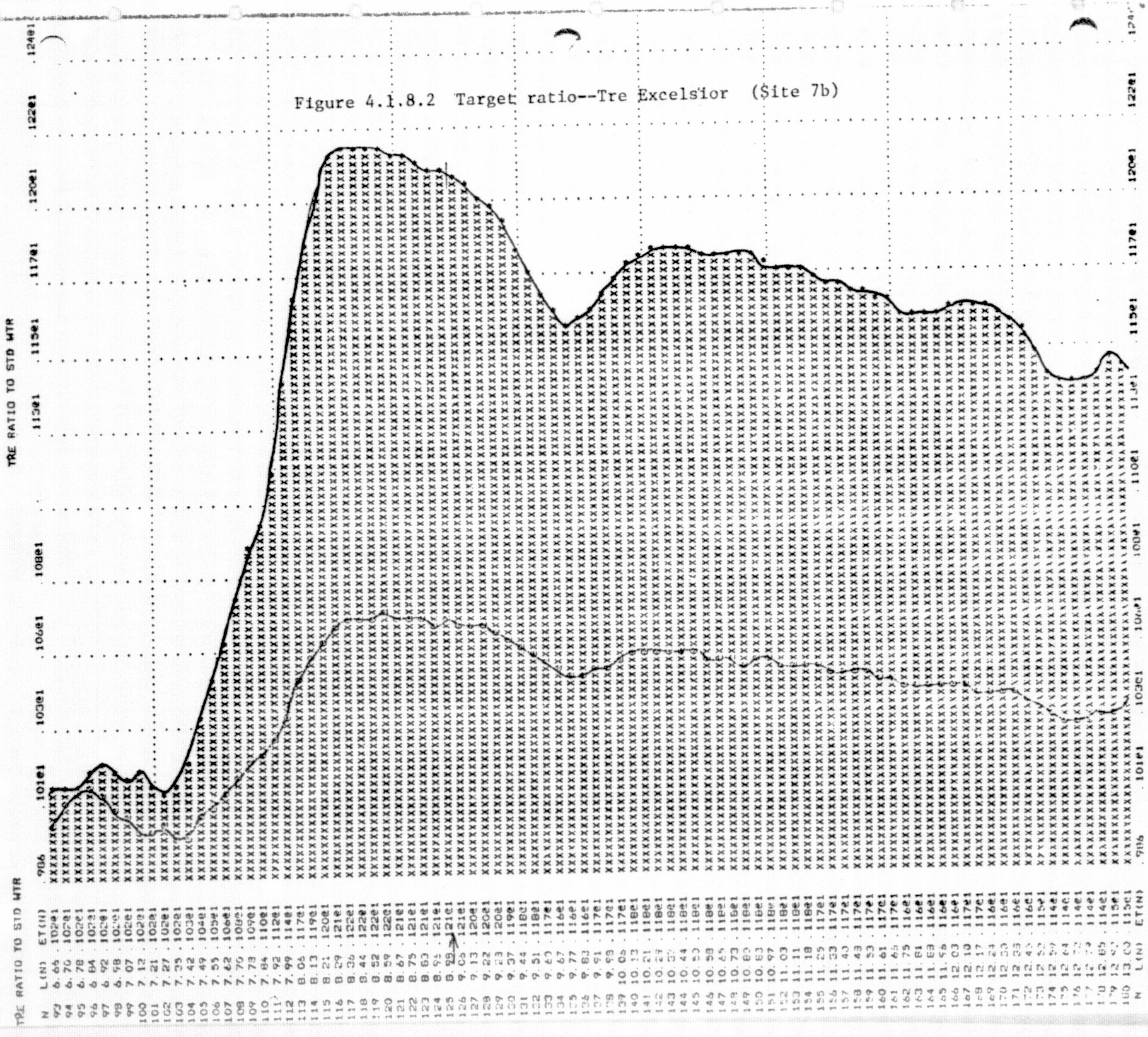


Table 4.1.9 Spectral data, emittance--Kgr-1 (granite) (Site 8a)

13:44 WED 14 MAY 75 Page 1 <EMBUDI>SL,11

STANFORD REMOTE SENSING LABORATORIES

MISSION 248 (AIRCRAFT DATA), (UP-RAMP SPECTRA)

KGR-1

From 16:29: 6.00 to 16:29: 11.00

5 spectra averaged

L(N)	ET(N)	SDEV	TT(N)	BB(N)	L(N)	ET(N)	SDEV	TT(N)	BB(N)
6,66	,570#8	,13#7	-19,66	,260#9	9,91	,286#9	,46#7	21,45	,358#9
6,70	,586#8	,11#7	-19,57	,264#9	9,98	,298#9	,49#7	23,97	,357#9
6,78	,618#8	,10#7	-19,03	,269#9	10,06	,312#9	,51#7	26,83	,356#9
6,84	,653#8	,68#6	-18,28	,274#9	10,13	,325#9	,52#7	29,60	,355#9
6,92	,741#8	,73#6	-15,48	,280#9	10,21	,335#9	,51#7	31,72	,354#9
6,98	,819#8	,88#6	-13,07	,284#9	10,29	,341#9	,50#7	33,01	,353#9
7,07	,901#8	,93#6	-11,02	,290#9	10,37	,343#9	,49#7	33,69	,352#9
7,12	,969#8	,12#7	-9,32	,294#9	10,44	,344#9	,49#7	34,06	,351#9
7,21	,107#9	,99#6	-7,11	,299#9	10,50	,344#9	,49#7	34,22	,350#9
7,27	,114#9	,88#6	-5,49	,303#9	10,58	,343#9	,48#7	34,38	,348#9
7,35	,123#9	,94#6	-3,64	,307#9	10,65	,343#9	,47#7	34,61	,347#9
7,42	,133#9	,91#6	-1,46	,311#9	10,73	,343#9	,46#7	34,76	,346#9
7,49	,144#9	,99#6	,95	,315#9	10,80	,341#9	,45#7	34,79	,344#9
7,55	,154#9	,10#7	3,01	,318#9	10,88	,340#9	,44#7	34,87	,343#9
7,62	,158#9	,11#7	3,36	,321#9	10,97	,339#9	,45#7	34,97	,341#9
7,70	,163#9	,12#7	3,87	,325#9	11,03	,338#9	,44#7	34,97	,339#9
7,78	,170#9	,13#7	4,83	,328#9	11,11	,336#9	,43#7	35,02	,338#9
7,84	,173#9	,14#7	5,08	,331#9	11,18	,335#9	,42#7	35,10	,336#9
7,92	,182#9	,19#7	6,53	,334#9	11,25	,333#9	,40#7	35,10	,334#9
7,99	,204#9	,24#7	11,05	,337#9	11,33	,331#9	,39#7	35,04	,333#9
8,06	,232#9	,32#7	16,41	,339#9	11,40	,330#9	,39#7	35,06	,331#9
8,13	,257#9	,40#7	20,79	,341#9	11,48	,328#9	,36#7	35,03	,329#9
8,21	,282#9	,51#7	24,96	,344#9	11,53	,326#9	,36#7	34,98	,327#9
8,29	,303#9	,60#7	28,21	,346#9	11,61	,324#9	,36#7	35,01	,326#9
8,36	,314#9	,66#7	29,83	,348#9	11,66	,322#9	,34#7	34,87	,324#9
8,44	,319#9	,72#7	30,24	,350#9	11,75	,319#9	,31#7	34,57	,322#9
8,52	,322#9	,75#7	30,46	,352#9	11,81	,317#9	,31#7	34,45	,320#9
8,59	,326#9	,76#7	30,85	,353#9	11,88	,315#9	,30#7	34,46	,319#9
8,67	,328#9	,76#7	30,93	,354#9	11,96	,313#9	,29#7	34,58	,316#9
8,75	,329#9	,76#7	30,96	,355#9	12,03	,311#9	,29#7	34,86	,315#9
8,83	,332#9	,75#7	31,22	,357#9	12,10	,312#9	,31#7	35,24	,313#9
8,96	,335#9	,77#7	31,54	,358#9	12,17	,311#9	,31#7	35,44	,311#9
8,98	,336#9	,75#7	31,64	,358#9	12,24	,309#9	,31#7	35,39	,309#9
9,06	,337#9	,74#7	31,69	,359#9	12,30	,306#9	,29#7	35,12	,307#9
9,13	,339#9	,76#7	31,82	,359#9	12,38	,302#9	,29#7	34,65	,305#9
9,22	,339#9	,74#7	31,77	,360#9	12,45	,297#9	,25#7	33,85	,303#9
9,28	,337#9	,72#7	31,43	,360#9	12,52	,291#9	,23#7	32,54	,301#9
9,37	,332#9	,70#7	30,39	,360#9	12,59	,285#9	,22#7	31,38	,299#9
9,44	,319#9	,65#7	27,75	,360#9	12,64	,281#9	,22#7	30,78	,297#9
9,51	,301#9	,58#7	24,53	,360#9	12,72	,278#9	,22#7	30,59	,295#9
9,60	,288#9	,53#7	21,97	,360#9	12,79	,277#9	,23#7	30,70	,293#9
9,67	,277#9	,48#7	19,64	,359#9	12,85	,277#9	,23#7	31,18	,291#9
9,77	,270#9	,44#7	18,18	,359#9	12,92	,276#9	,26#7	31,64	,289#9
9,83	,274#9	,44#7	19,04	,358#9	13,00	,274#9	,32#7	31,52	,287#9

MAX TT(N) IS 35,44 AT 12,17

SPRBBT= 44,84 , SPEDET= ,9731#-2 , SPIBBT= 25,89 , RAIBBT= 43,50

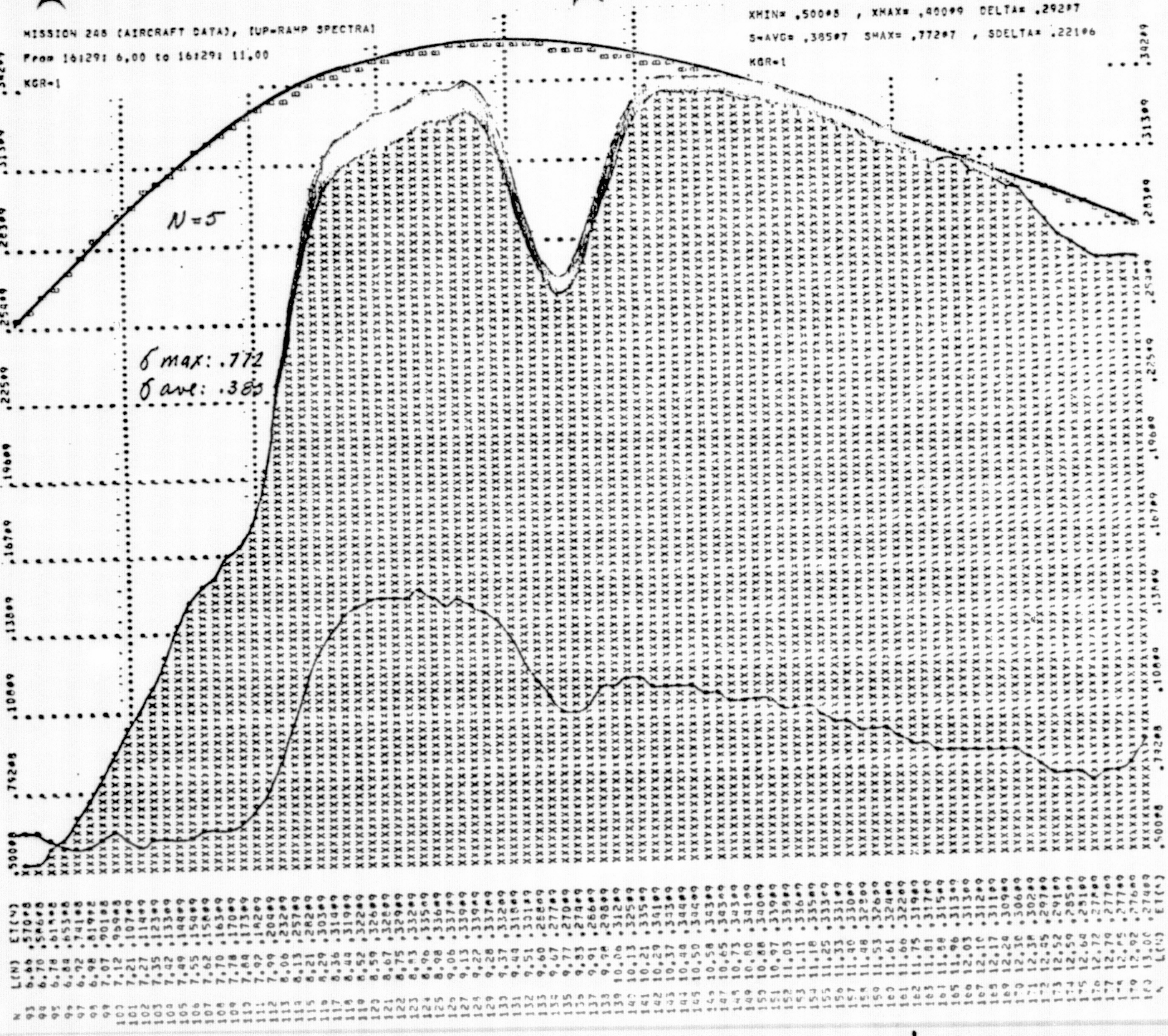


Figure 4.1.9.1 Target emittance--Kgr-1 granites (Site 8a)

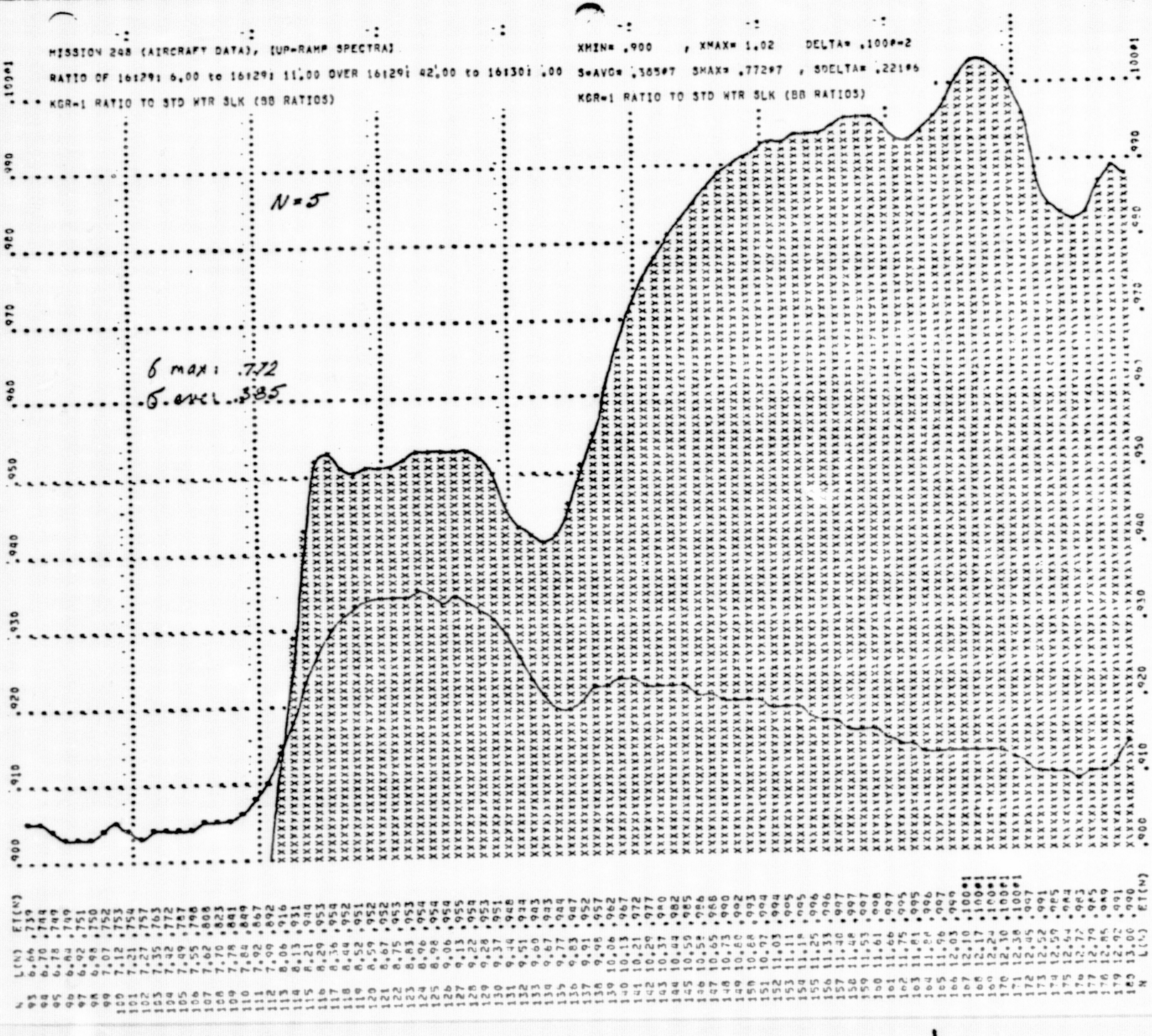


Figure 4.1.9.2 Target ratio --Kgr-1 granites (Site 8a)

Table 4.1.10 Spectral data, emittance--Kgr-2 (granites) (Site 8b)

13:46 WED 14 MAY 75 Page 1 <EMBUDI>SL,;2

STANFORD REMOTE SENSING LABORATORIES

MISSION 248 (AIRCRAFT DATA), (UP-RAMP SPECTRA)

SL KGR-2

From 16:13: 11,00 to 16:13: 20,00

10 spectra averaged

L(N)	ET(N)	SDEV	TT(N)	BB(N)	L(N)	ET(N)	SDEV	TT(N)	BB(N)
6,66	,459#8	,77#6	-25,94	,246#9	9,91	,273#9	,11#8	18,63	,344#9
6,70	,469#8	,81#6	-26,11	,250#9	9,98	,285#9	,12#8	21,23	,344#9
6,78	,492#8	,79#6	-25,78	,255#9	10,06	,299#9	,13#8	24,18	,343#9
6,84	,528#8	,11#7	-24,68	,260#9	10,13	,312#9	,14#8	27,03	,342#9
6,92	,618#8	,13#7	-21,20	,265#9	10,21	,323#9	,14#8	29,21	,341#9
6,98	,698#8	,88#6	-18,23	,269#9	10,29	,328#9	,14#8	30,52	,340#9
7,07	,786#8	,95#6	-15,58	,275#9	10,37	,331#9	,14#8	31,25	,339#9
7,12	,859#8	,70#6	-13,40	,279#9	10,44	,332#9	,14#8	31,62	,338#9
7,21	,955#8	,92#6	-10,95	,284#9	10,50	,332#9	,14#8	31,78	,337#9
7,27	,103#9	,10#7	-9,07	,288#9	10,58	,332#9	,14#8	31,94	,336#9
7,35	,112#9	,82#6	-7,13	,292#9	10,65	,332#9	,14#8	32,20	,335#9
7,42	,121#9	,68#6	-4,99	,296#9	10,73	,331#9	,14#8	32,38	,334#9
7,49	,131#9	,90#6	-2,61	,300#9	10,80	,330#9	,14#8	32,44	,332#9
7,55	,141#9	,11#7	-,44	,302#9	10,88	,329#9	,14#8	32,55	,331#9
7,62	,145#9	,13#7	-,12	,306#9	10,97	,328#9	,14#8	32,68	,329#9
7,70	,149#9	,19#7	,31	,310#9	11,03	,327#9	,13#8	32,70	,328#9
7,78	,156#9	,27#7	1,22	,313#9	11,11	,326#9	,13#8	32,75	,326#9
7,84	,159#9	,32#7	1,58	,316#9	11,18	,325#9	,13#8	32,85	,325#9
7,92	,168#9	,41#7	3,05	,319#9	11,25	,323#9	,13#8	32,82	,323#9
7,99	,189#9	,58#7	7,69	,321#9	11,33	,321#9	,13#8	32,75	,322#9
8,06	,217#9	,76#7	13,24	,324#9	11,40	,319#9	,13#8	32,73	,320#9
8,13	,242#9	,94#7	17,82	,326#9	11,48	,317#9	,12#8	32,69	,318#9
8,21	,266#9	,11#8	22,03	,329#9	11,53	,316#9	,12#8	32,65	,317#9
8,29	,287#9	,13#8	25,33	,331#9	11,61	,314#9	,12#8	32,68	,315#9
8,36	,298#9	,14#8	26,95	,333#9	11,66	,312#9	,12#8	32,52	,314#9
8,44	,302#9	,14#8	27,30	,335#9	11,75	,309#9	,11#8	32,21	,312#9
8,52	,305#9	,15#8	27,47	,337#9	11,81	,307#9	,11#8	32,07	,310#9
8,59	,308#9	,15#8	27,86	,338#9	11,88	,305#9	,11#8	32,04	,309#9
8,67	,310#9	,15#8	27,93	,339#9	11,96	,303#9	,11#8	32,10	,307#9
8,75	,312#9	,15#8	27,94	,341#9	12,03	,303#9	,11#8	32,44	,305#9
8,83	,315#9	,15#8	28,26	,342#9	12,10	,303#9	,11#8	32,82	,303#9
8,96	,319#9	,15#8	28,64	,343#9	12,17	,302#9	,11#8	33,00	,301#9
8,98	,320#9	,15#8	28,75	,344#9	12,24	,300#9	,11#8	32,96	,299#9
9,06	,321#9	,16#8	28,82	,344#9	12,30	,297#9	,11#8	32,72	,298#9
9,13	,322#9	,16#8	28,93	,345#9	12,38	,293#9	,10#8	32,22	,295#9
9,22	,323#9	,16#8	28,87	,345#9	12,45	,288#9	,98#7	31,40	,294#9
9,28	,321#9	,16#8	28,52	,346#9	12,52	,281#9	,91#7	30,02	,292#9
9,37	,316#9	,15#8	27,53	,346#9	12,59	,275#9	,84#7	28,76	,290#9
9,44	,303#9	,14#8	24,93	,346#9	12,64	,271#9	,81#7	28,03	,288#9
9,51	,287#9	,13#8	21,76	,346#9	12,72	,268#9	,78#7	27,73	,286#9
9,60	,275#9	,11#8	19,18	,346#9	12,79	,267#9	,77#7	27,75	,285#9
9,67	,264#9	,10#8	16,81	,346#9	12,85	,267#9	,77#7	28,17	,283#9
9,77	,257#9	,10#8	15,30	,345#9	12,92	,266#9	,78#7	28,65	,281#9
9,83	,261#9	,10#8	16,15	,345#9	13,00	,264#9	,77#7	28,59	,279#9

MAX TT(N) IS 33,00 AT 12,17

SPRBBT= 44,23 , SPEDET= ,9564#-2 , SPIBBT= 26,09 , RAIBBT= 44,45

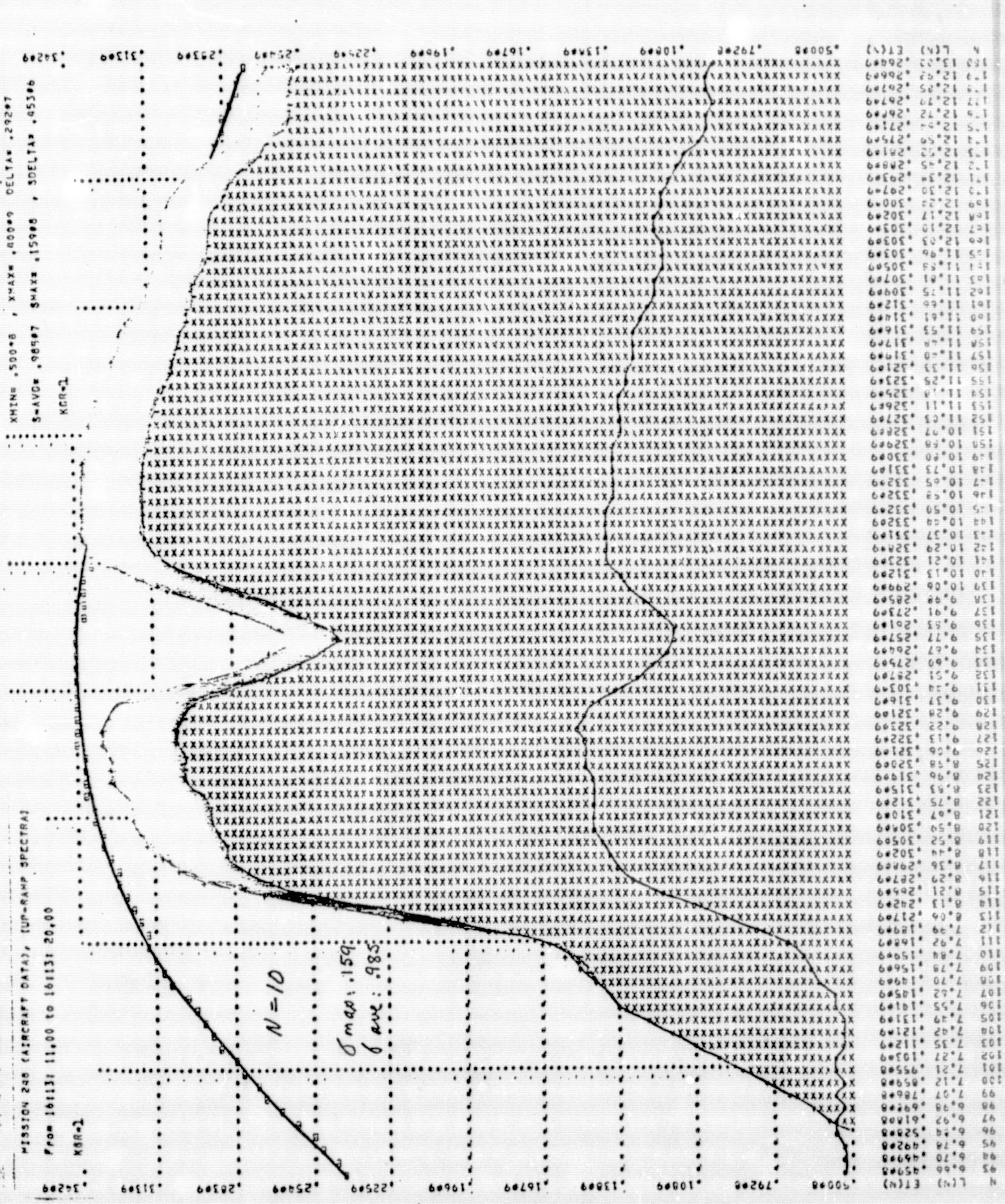


Figure 4.1.10.1 Target emittance--Kgr-2 granites (Site 8b)

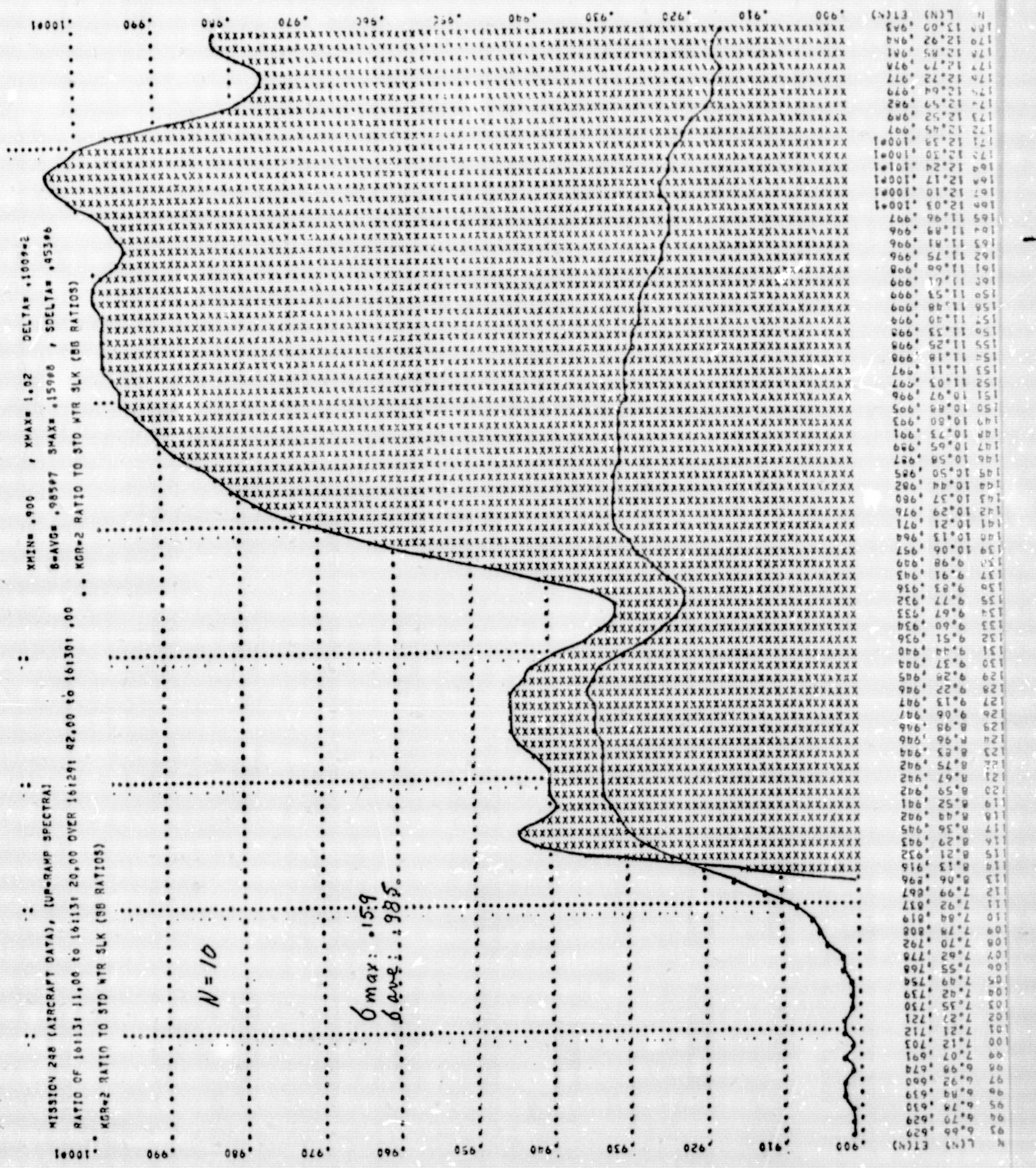


Figure 4.1.10.2 Target ratio--Kgr-2 granites (Site 8b)

Table 4.1.11 Qal-NL (Hawthorne vs. lake) Site 9)

STANFORD REMOTE SENSING LABORATORIES

MISSION 248 (AIRCRAFT DATA), (UP-RAMP SPECTRA)

QAL NL

From 16:30: 41.00 to 16:30: 49.00

9 spectra averaged

L(N)	ET(N)	SDEV	TT(N)	BB(N)	L(N)	ET(N)	SDEV	TT(N)	BB(N)
6.66	.57508	.6606	-19.38	.25609	9.91	.28109	.2307	20.36	.35309
6.70	.58908	.8806	-19.47	.25909	9.98	.29309	.2507	22.87	.35309
6.78	.61708	.8806	-19.11	.26509	10.06	.30609	.2607	25.72	.35209
6.84	.65208	.9406	-18.30	.26909	10.13	.32009	.2707	28.52	.35109
6.92	.73908	.9006	-15.58	.27509	10.21	.33009	.2907	30.66	.35009
6.98	.81808	.1007	-13.11	.27909	10.29	.33609	.2907	31.95	.34909
7.07	.90308	.1207	-10.97	.28509	10.37	.33809	.2907	32.66	.34809
7.12	.97108	.1407	-9.26	.28909	10.44	.33909	.2907	33.04	.34709
7.21	.10709	.1207	-7.04	.29409	10.50	.33909	.2907	33.21	.34609
7.27	.11409	.9706	-5.51	.29809	10.58	.33809	.2607	33.38	.34509
7.35	.12209	.9106	-3.78	.30209	10.65	.33909	.2807	33.65	.34309
7.42	.13209	.6806	-1.72	.30609	10.73	.33809	.2807	33.86	.34209
7.49	.14309	.6806	.50	.31009	10.80	.33709	.2707	33.93	.34009
7.55	.15209	.7906	2.45	.31309	10.88	.33609	.2707	34.03	.33909
7.62	.15609	.7706	2.81	.31709	10.97	.33509	.2707	34.14	.33709
7.70	.16109	.8406	3.25	.32009	11.03	.33409	.2707	34.15	.33609
7.78	.16709	.9306	4.10	.32309	11.11	.33209	.2707	34.20	.33409
7.84	.17109	.9506	4.42	.32609	11.18	.33109	.2607	34.28	.33309
7.92	.17909	.1107	5.80	.32909	11.25	.33009	.2607	34.28	.33109
7.99	.20009	.1407	10.20	.33209	11.33	.32809	.2607	34.25	.32909
8.06	.22809	.1807	15.43	.33509	11.40	.32609	.2507	34.23	.32709
8.13	.25109	.2207	19.74	.33709	11.48	.32409	.2507	34.16	.32609
8.21	.27609	.2407	23.77	.33909	11.53	.32209	.2507	34.12	.32409
8.29	.29509	.2707	26.89	.34109	11.61	.32009	.2407	34.16	.32209
8.36	.30609	.2707	28.42	.34309	11.66	.31909	.2407	33.99	.32109
8.44	.31009	.2607	28.75	.34509	11.75	.31509	.2407	33.71	.31909
8.52	.31309	.2607	28.90	.34709	11.81	.31309	.2407	33.63	.31709
8.59	.31609	.2707	29.28	.34809	11.88	.31209	.2307	33.65	.31509
8.67	.31809	.2707	29.36	.35009	11.96	.31009	.2207	33.73	.31309
8.75	.32009	.2807	29.37	.35109	12.03	.31009	.2307	34.09	.31209
8.83	.32209	.2807	29.58	.35209	12.10	.30909	.2207	34.50	.31009
8.96	.32609	.2607	29.91	.35309	12.17	.30809	.2107	34.68	.30809
8.98	.32709	.2607	29.98	.35409	12.24	.30609	.2207	34.65	.30609
9.06	.32809	.2607	29.99	.35409	12.30	.30309	.2207	34.44	.30409
9.13	.32909	.2607	30.08	.35509	12.38	.29909	.2007	33.95	.30209
9.22	.32909	.2707	30.04	.35509	12.45	.29509	.2007	33.13	.30009
9.28	.32709	.2707	29.68	.35509	12.52	.28809	.1907	31.78	.29809
9.37	.32709	.2707	28.66	.35609	12.59	.28209	.1707	30.55	.29609
9.44	.30909	.2607	26.11	.35609	12.64	.27809	.1607	29.85	.29509
9.51	.29309	.2507	23.07	.35609	12.72	.27509	.1507	29.59	.29209
9.60	.28209	.2407	20.64	.35509	12.79	.27309	.1507	29.63	.29009
9.67	.27109	.2307	18.44	.35509	12.85	.27309	.1407	30.08	.28909
9.77	.26509	.2307	17.07	.35409	12.92	.27309	.1407	30.57	.28709
9.83	.26909	.2207	17.98	.35409	13.00	.27109	.1407	30.51	.28509

MAX TT(N) IS 34.68 AT 12.17

SPRBBT= 44.84 , SPEDET= .97500-2 , SPIDBT= 25.86 , RAIBBT= 43.20

TOP

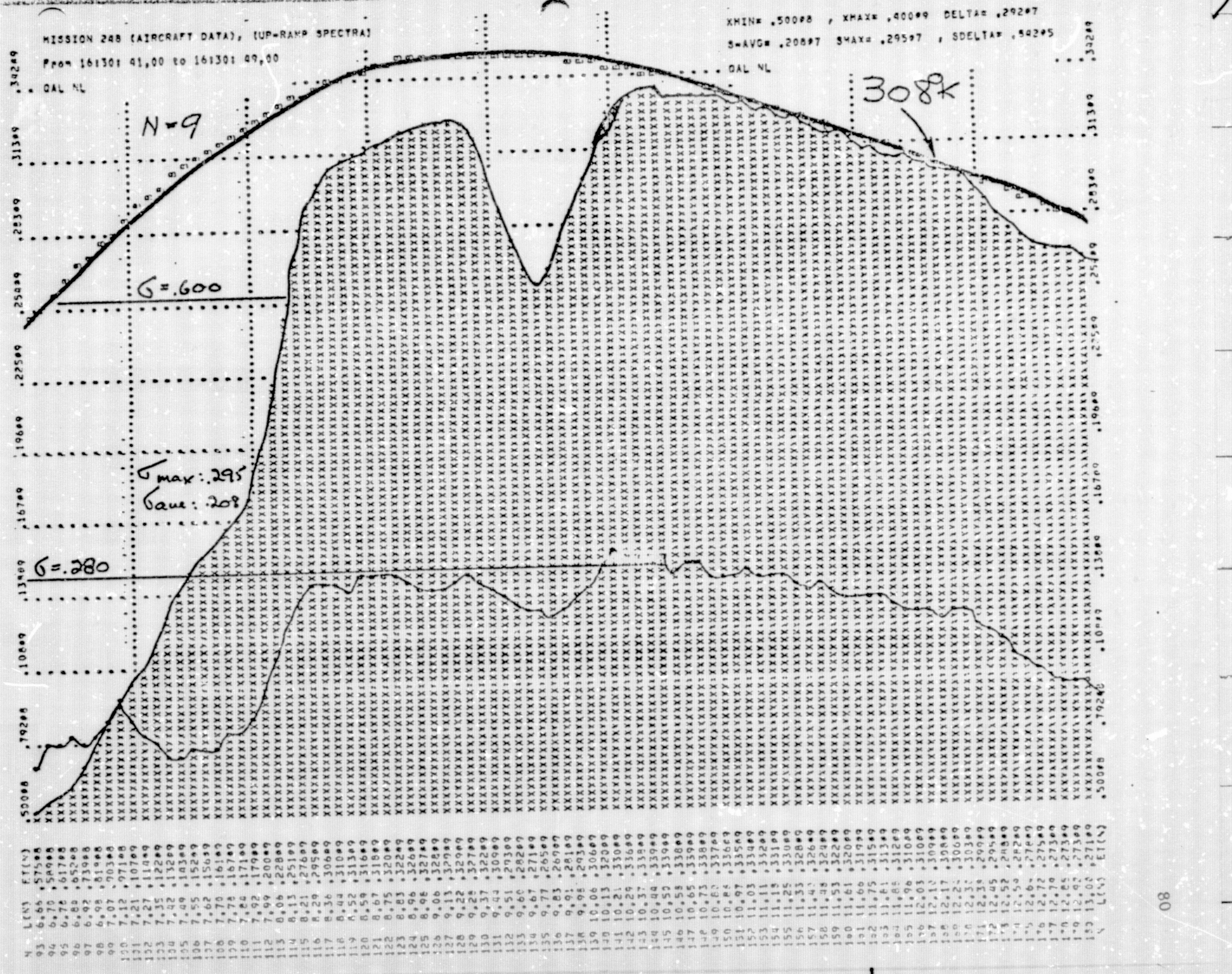


Figure 4.1.11.1 Target emittance--Qal-NL (Site 9)

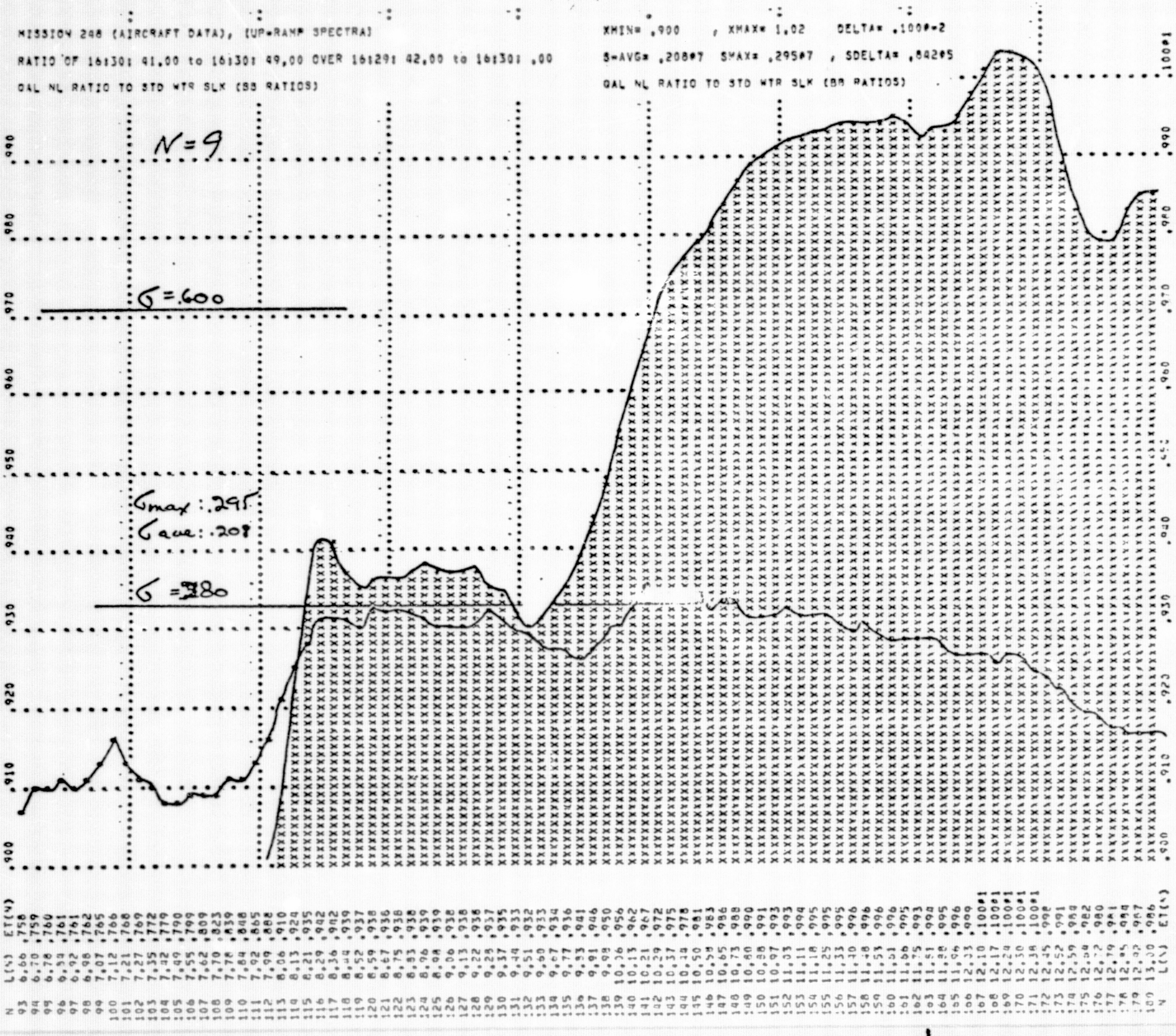


Figure 4.1.11.2 Target ratio --Qal-NL (Site 9)

Table 4.1.12 QTm-N (mafic volcs) (Site 10)

13:13 THU 10 APR 75 Page 1 <EWBUDI>SRL.17

STANFORD REMOTE SENSING LABORATORIES

MISSION 249 (AIRCRAFT DATA), (UP-RAMP SPECTRA)

QTM-N Mafic volcs

From 16:31: 41,00 to 16:31: 45,00

5 spectra averaged

L(N)	ET(N)	SDEV	TT(N)	BB(N)	L(N)	ET(N)	SDEV	TT(N)	BB(N)
6.65	.597*8	.97*6	-18.28	.260*9	9.91	.294*9	.90*7	23.11	.364*9
6.70	.611*9	.70*6	-19.17	.271*9	9.98	.306*9	.95*7	25.67	.364*9
6.78	.543*9	.60*6	-17.92	.277*9	10.06	.321*9	.10*8	28.63	.363*9
6.84	.676*8	.67*6	-17.11	.282*9	10.13	.335*9	.11*8	31.50	.362*9
6.92	.707*3	.74*6	-14.40	.289*9	10.21	.345*9	.11*8	33.65	.361*9
6.98	.846*8	.93*5	-12.00	.292*9	10.29	.351*9	.12*8	34.91	.360*9
7.07	.929*8	.91*6	-10.91	.299*9	10.37	.353*9	.11*8	35.54	.358*9
7.12	.103*9	.79*5	-8.22	.301*9	10.44	.353*9	.11*8	35.81	.357*9
7.21	.110*9	.63*5	-6.09	.307*9	10.50	.352*9	.11*8	35.95	.356*9
7.27	.117*9	.72*5	-4.65	.311*9	10.58	.351*9	.11*8	35.91	.355*9
7.35	.125*9	.83*6	-2.96	.315*9	10.65	.351*9	.11*8	36.09	.353*9
7.42	.135*9	.71*6	-.83	.319*9	10.73	.350*9	.11*8	36.22	.352*9
7.49	.116*9	.94*6	1.50	.323*9	10.80	.349*9	.11*8	36.20	.350*9
7.55	.156*9	.11*7	3.58	.326*9	10.88	.347*9	.11*8	36.24	.349*9
7.62	.161*9	.14*7	3.96	.329*9	10.97	.345*9	.11*8	36.31	.347*9
7.70	.166*9	.20*7	4.50	.333*9	11.03	.344*9	.11*8	36.28	.345*9
7.78	.172*9	.25*7	5.38	.336*9	11.11	.342*9	.10*8	36.29	.343*9
7.84	.176*9	.29*7	5.68	.337*9	11.18	.341*9	.10*8	36.35	.342*9
7.92	.135*9	.35*7	7.25	.342*9	11.25	.339*9	.10*8	36.32	.340*9
7.99	.209*9	.45*7	12.02	.345*9	11.33	.337*9	.10*8	36.22	.338*9
8.06	.239*9	.63*7	17.66	.347*9	11.40	.335*9	.10*8	36.19	.336*9
8.13	.266*9	.77*7	22.41	.349*9	11.48	.332*9	.99*7	36.12	.334*9
8.21	.273*9	.93*7	26.91	.352*9	11.53	.331*9	.97*7	36.08	.333*9
8.29	.317*9	.11*8	30.54	.354*9	11.61	.329*9	.95*7	36.13	.331*9
8.36	.330*9	.12*8	32.49	.356*9	11.66	.327*9	.93*7	36.00	.330*9
8.44	.336*9	.12*8	33.09	.358*9	11.75	.324*9	.89*7	35.71	.327*9
8.52	.340*9	.12*8	33.44	.359*9	11.81	.322*9	.87*7	35.63	.326*9
8.59	.344*9	.12*8	33.94	.361*9	11.88	.320*9	.88*7	35.62	.324*9
8.67	.346*9	.12*8	34.00	.362*9	11.96	.319*9	.89*7	35.73	.322*9
8.75	.348*9	.12*8	34.03	.363*9	12.03	.318*9	.88*7	36.09	.320*9
8.83	.351*9	.12*8	34.37	.364*9	12.10	.317*9	.90*7	36.51	.318*9
8.96	.355*9	.12*8	34.78	.366*9	12.17	.316*9	.92*7	36.69	.316*9
8.98	.356*9	.13*8	34.89	.366*9	12.24	.314*9	.90*7	36.66	.314*9
9.06	.357*9	.12*8	34.95	.366*9	12.30	.311*9	.87*7	36.37	.312*9
9.13	.358*9	.13*8	35.05	.367*9	12.38	.307*9	.84*7	35.87	.309*9
9.22	.358*9	.13*8	34.97	.367*9	12.45	.302*9	.79*7	35.09	.308*9
9.28	.355*9	.12*8	34.57	.367*9	12.52	.295*9	.73*7	33.79	.306*9
9.37	.319*9	.12*8	33.39	.367*9	12.59	.289*9	.69*7	32.57	.304*9
9.44	.333*9	.11*8	30.59	.367*9	12.64	.285*9	.65*7	32.01	.302*9
9.51	.314*9	.10*8	27.01	.367*9	12.72	.283*9	.65*7	31.88	.300*9
9.60	.299*9	.98*7	24.12	.367*9	12.79	.281*9	.65*7	32.03	.298*9
9.67	.286*9	.89*7	21.47	.366*9	12.85	.282*9	.65*7	32.55	.296*9
9.77	.278*9	.93*7	19.31	.366*9	12.92	.282*9	.69*7	33.17	.294*9
9.83	.282*9	.96*7	20.67	.365*9	13.00	.280*9	.66*7	33.13	.291*9

MAX TT(N) IS 36.69 AT 12.17

SPRUDT= 44.89 , SPECET= .9627*-2 , SPIDPT= 25.81 , RAIUBT= 42.98

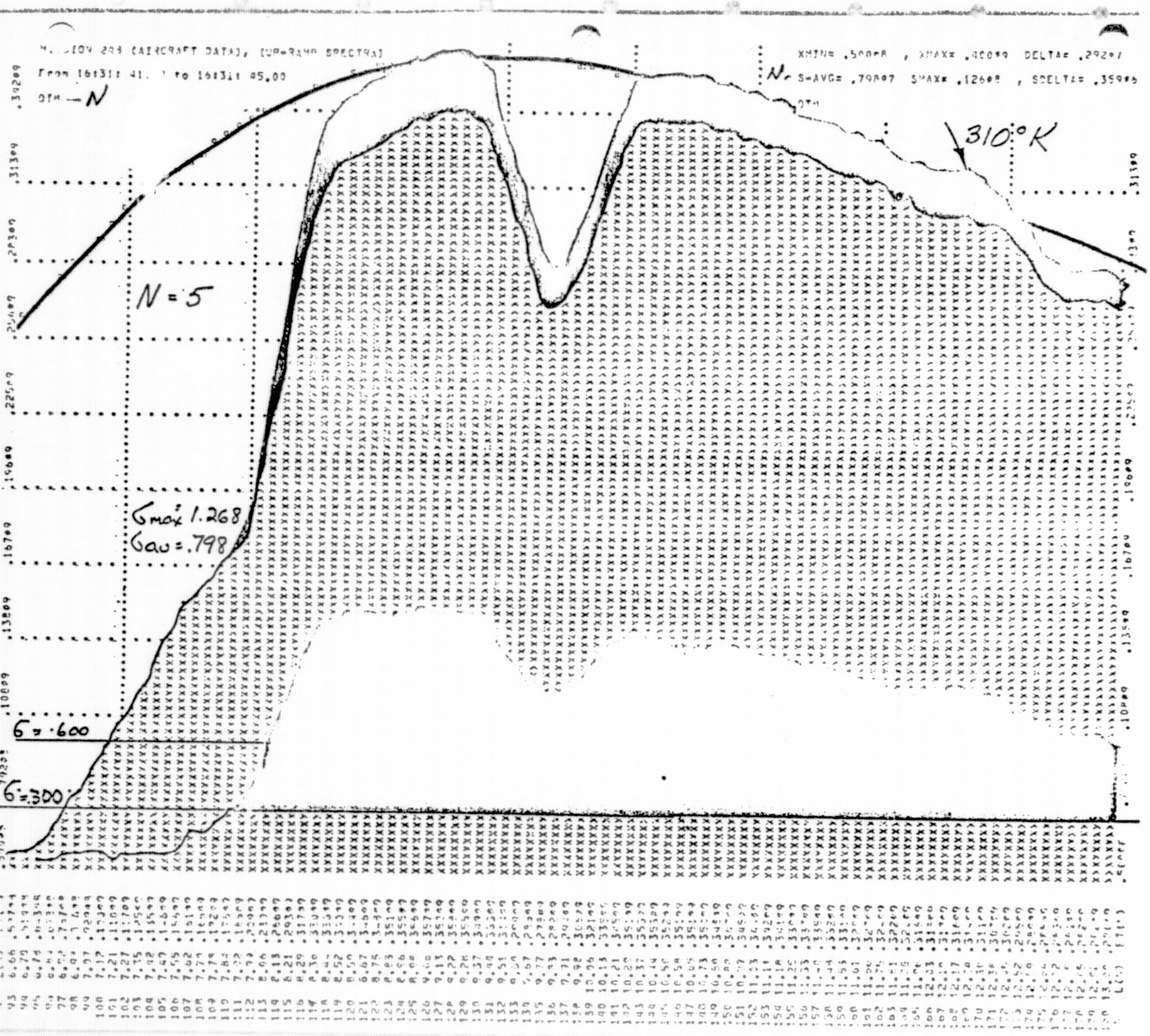


Figure 4.1.12.1 Target emittance--QTm-N (volcs) (Site 10)

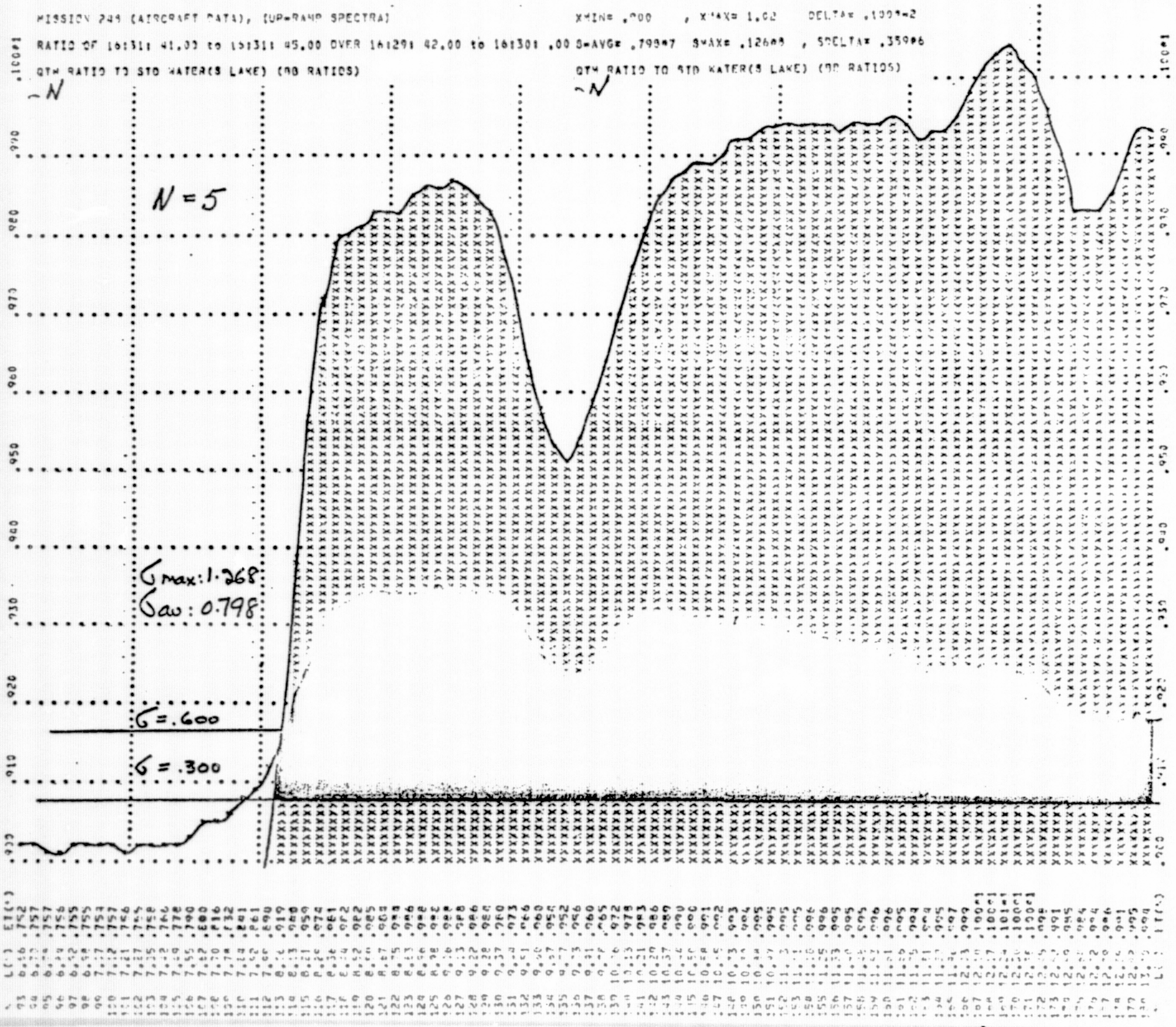


Figure 4.1.12.2 Target ratio--QTm-N (volcs) (Site 10)

Table 4.1.13 QT-S (mafic volcs) (Site 11)

14:22 WED 16 APR 75 Page 1 <EWBUDI>SL,16

STANFORD REMOTE SENSING LABORATORIES

MISSION 248 (AIRCRAFT DATA), [UP-RAMP SPECTRA]

QTM-S Mafic Volcs

From 16:32: 22,00 to 16:32: 30,00

8 spectra averaged

L(N)	ET(N)	SDEV	TT(N)	BB(N)	L(N)	ET(N)	SDEV	TT(N)	BB(N)
6,66	,602Ø8	,10Ø7	-18,02	,244Ø9	9,91	,279Ø9	.11Ø8	20.02	,342Ø9
6,70	,618Ø8	,96Ø6	-17,98	,247Ø9	9.98	,291Ø9	.12Ø8	22,46	,341Ø9
6,78	,648Ø8	,10Ø7	-17,60	,253Ø9	10,06	,304Ø9	.12Ø8	25,23	,341Ø9
6,84	,681Ø8	,76Ø6	-16,95	,257Ø9	10,13	,317Ø9	.13Ø8	27,92	,340Ø9
6,92	.770Ø8	,44Ø6	-14.27	,263Ø9	10,21	,326Ø9	.14Ø8	29,93	,339Ø9
6,98	.847Ø8	,67Ø6	-11,99	,267Ø9	10,29	,331Ø9	.14Ø8	31,09	,338Ø9
7.07	.930Ø8	,68Ø6	-9,96	.272Ø9	10,37	,333Ø9	.14Ø8	31,65	,337Ø9
7.12	.100Ø9	,76Ø6	-8,17	.276Ø9	10,44	,333Ø9	.14Ø8	31,89	,336Ø9
7,21	.110Ø9	,70Ø6	-6,00	,281Ø9	10,50	,333Ø9	.14Ø8	31,94	,335Ø9
7,27	.117Ø9	,96Ø6	-4,53	,285Ø9	10,58	,337Ø9	.13Ø8	32,01	,334Ø9
7,35	,125Ø9	,12Ø7	-2,85	,289Ø9	10,65	,332Ø9	.13Ø8	32,18	,333Ø9
7,42	,135Ø9	,10Ø7	-,90	,293Ø9	10,73	,331Ø9	.13Ø8	32,28	,332Ø9
7,49	.146Ø9	,12Ø7	1,32	,297Ø9	10,80	,329Ø9	.13Ø8	32,25	,330Ø9
7.55	.155Ø9	,15Ø7	3,24	.300Ø9	10,88	,328Ø9	.13Ø8	32,28	,329Ø9
7,62	.159Ø9	,20Ø7	3,55	,303Ø9	10,97	,327Ø9	.13Ø8	32,34	,327Ø9
7,70	.163Ø9	,22Ø7	3,93	.307Ø9	11,03	,325Ø9	.13Ø8	32,30	,326Ø9
7,78	.169Ø9	,29Ø7	4,69	,310Ø9	11,11	,324Ø9	.13Ø8	32,31	,324Ø9
7,84	.172Ø9	,32Ø7	4,86	,313Ø9	11,18	,323Ø9	.12Ø8	32,37	,323Ø9
7,92	.180Ø9	,42Ø7	6,15	,316Ø9	11,25	,321Ø9	.12Ø8	32,33	,321Ø9
7,99	,201Ø9	,57Ø7	10,38	.318Ø9	11,33	,319Ø9	.12Ø8	32,27	,320Ø9
8,06	,228Ø9	,78Ø7	15,49	.321Ø9	11,40	,317Ø9	.12Ø8	32,24	,318Ø9
8,13	,252Ø9	,94Ø7	19,81	.323Ø9	11,48	,315Ø9	.12Ø8	32,16	,316Ø9
8,21	,277Ø9	,11Ø8	23,96	,326Ø9	11,53	,314Ø9	.12Ø8	32,12	,315Ø9
8.29	.298Ø9	,13Ø8	27.27	,328Ø9	11,61	,312Ø9	.12Ø8	32,18	,313Ø9
8,36	.310Ø9	,13Ø8	29,06	,330Ø9	11,66	,310Ø9	.12Ø8	32,05	,312Ø9
8,44	,315Ø9	,14Ø8	29,66	,332Ø9	11,75	,307Ø9	.11Ø8	31,80	,310Ø9
8,52	,319Ø9	,14Ø8	30,00	,334Ø9	11,81	,305Ø9	.11Ø8	31,72	,308Ø9
8,59	,323Ø9	,14Ø8	30,40	,335Ø9	11,88	,304Ø9	.11Ø8	31,73	,307Ø9
8,67	,325Ø9	,15Ø8	30,47	,337Ø9	11,96	,302Ø9	.10Ø8	31,78	,305Ø9
8,75	,327Ø9	,15Ø8	30,50	,339Ø9	12,03	,302Ø9	.10Ø8	32,07	,303Ø9
8,83	,329Ø9	,15Ø8	30,77	,339Ø9	12,10	,301Ø9	.11Ø8	32,41	,301Ø9
8,96	,333Ø9	,15Ø8	31,10	,341Ø9	12,17	,300Ø9	.10Ø8	32,56	,299Ø9
8,98	,334Ø9	,15Ø8	31,18	,341Ø9	12,24	,290Ø9	.10Ø8	32,52	,298Ø9
9,06	,335Ø9	,15Ø8	31,21	,342Ø9	12,30	,295Ø9	.10Ø8	32,33	,296Ø9
9,13	,336Ø9	,15Ø8	31,31	,342Ø9	12,38	,292Ø9	.98Ø7	31,93	,294Ø9
9,22	,336Ø9	,15Ø8	31,24	,343Ø9	12,45	,288Ø9	.94Ø7	31,30	,292Ø9
9,28	,334Ø9	,15Ø8	30,89	,343Ø9	12,52	,282Ø9	.89Ø7	30,20	,290Ø9
9,37	,329Ø9	,14Ø8	29,80	,343Ø9	12,59	,277Ø9	.83Ø7	29,21	,288Ø9
9,44	,314Ø9	,13Ø8	27,06	,343Ø9	12,64	,274Ø9	.81Ø7	28,69	,287Ø9
9,51	,297Ø9	,12Ø8	23,72	,343Ø9	12,72	,271Ø9	.80Ø7	28,56	,285Ø9
9,60	,283Ø9	,11Ø8	20,98	,343Ø9	12,79	,270Ø9	.80Ø7	28,67	,283Ø9
9,67	,271Ø9	,11Ø8	18,47	,343Ø9	12,85	,270Ø9	.81Ø7	29,12	,281Ø9
9,77	,264Ø9	,10Ø8	16,88	,343Ø9	12,92	,270Ø9	.80Ø7	29,61	,279Ø9
9,83	,268Ø9	,10Ø8	17,70	,342Ø9	13,00	,268Ø9	.77Ø7	29,59	,277Ø9

MAX TT(N) IS 32,56 AT 12,17

SPRDBT= 44,91 , SPEDET= ,9646Ø-2 , SPIBBT= 25,86 , RAIBBT= 42,92

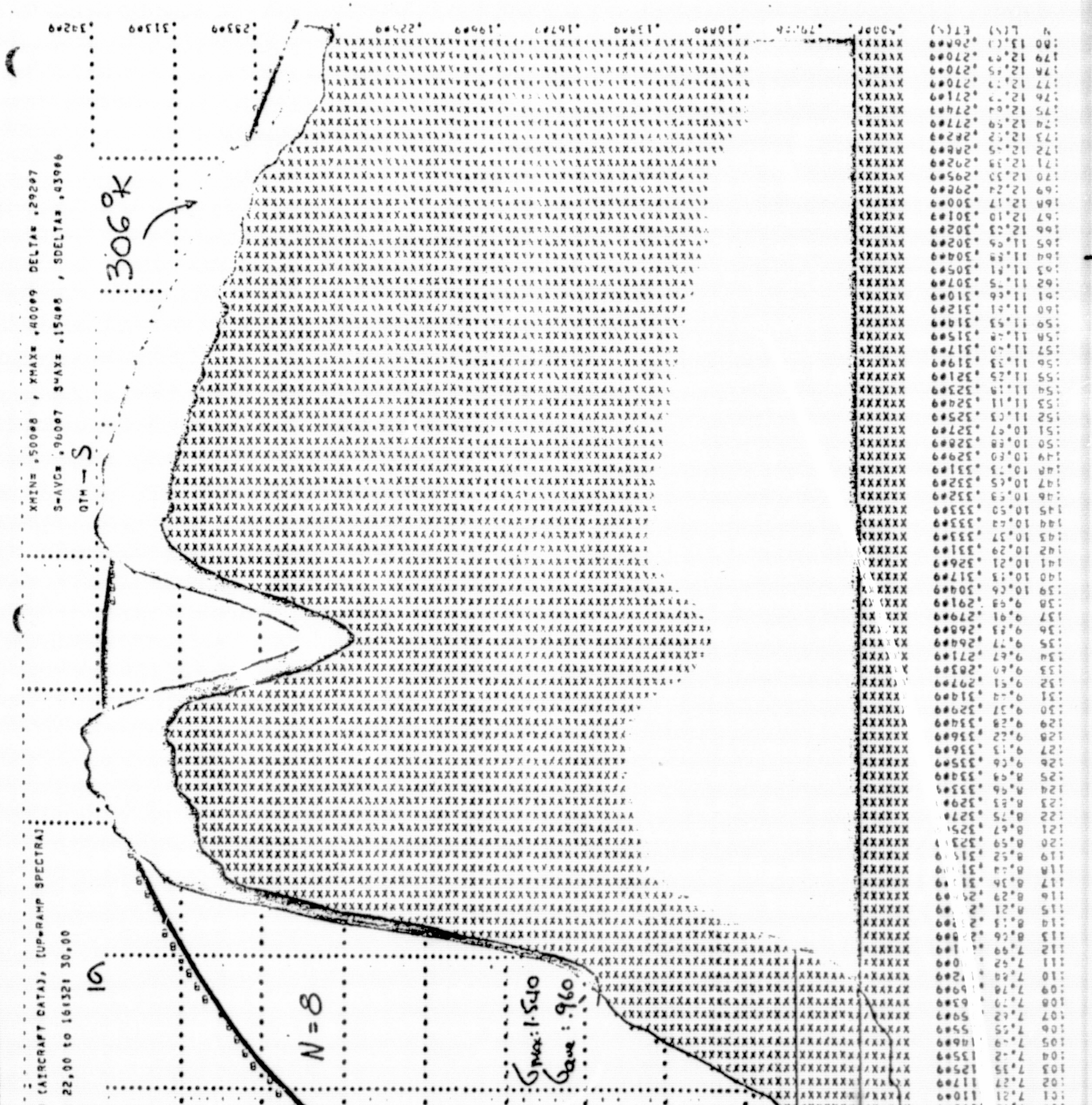


Figure 4.1.13.1 Target emittance--QTm-S (volcs) (Site 11)

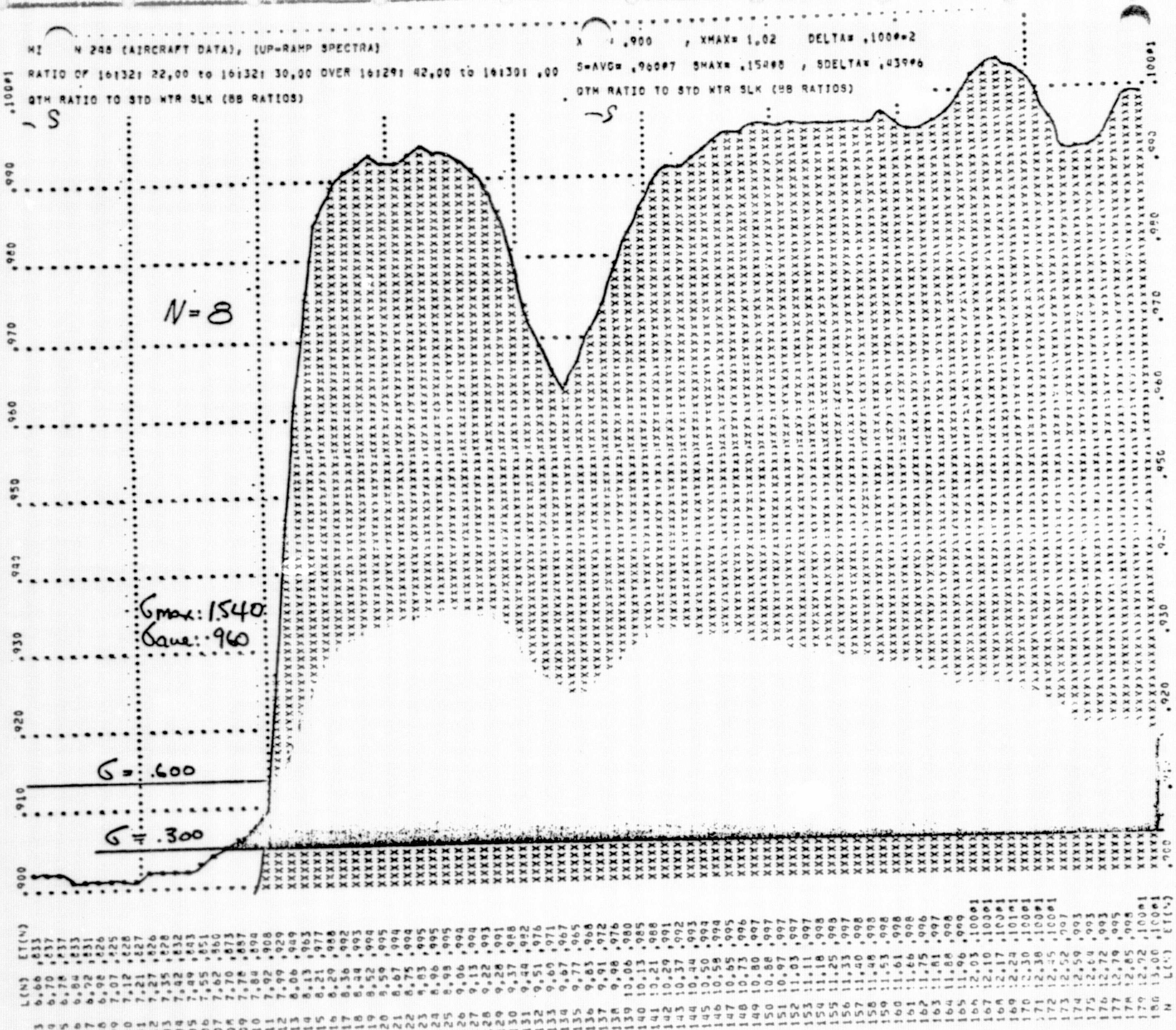


Figure 4.1.13.2 Target ratio--QTm-S (volcs) (Site 11)

Table 4.1.14 Qal-NNL (Site 12)

14:32 WED 16 APR 75 Page 1 <EMBUDI>SL.;3

STANFORD REMOTE SENSING LABORATORIES

MISSION 246 (AIRCRAFT DATA), (UP-RAMP SPECTRA)

QAL NNL

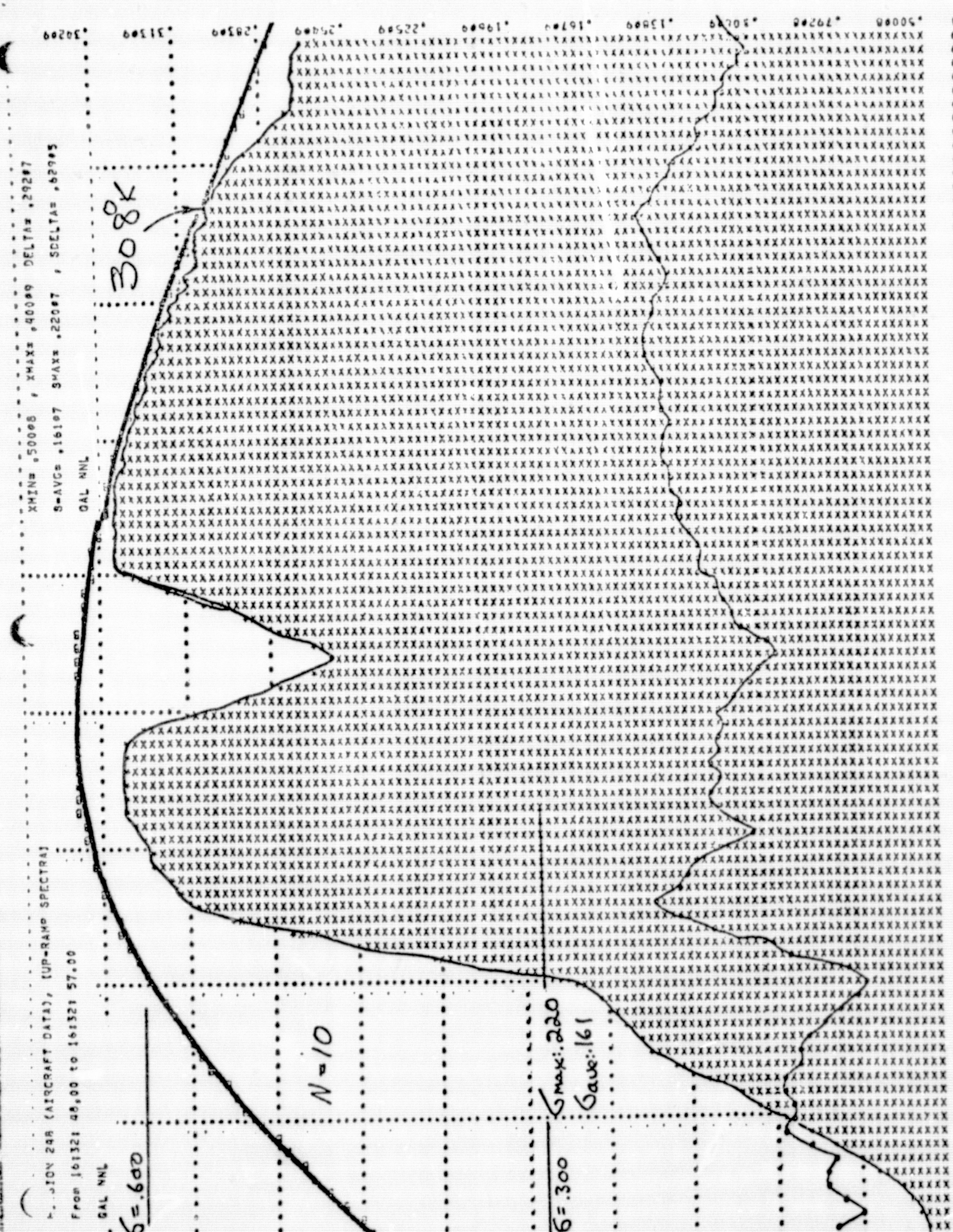
From 16:32: 48,00 to 16:32: 57,00

10 spectra averaged

L(N)	ET(N)	SDEV	TT(N)	BB(N)	L(N)	ET(N)	SDEV	TT(N)	BB(N)
6,66	,603•8	,88•6	-17,98	,256•9	9,91	,284•9	,14•7	21,03	,353•9
6,70	,617•8	,66•6	-18,03	,259•9	9,98	,296•9	,16•7	23,59	,353•9
6,78	,647•8	,76•6	-17,64	,265•9	10,06	,310•9	,16•7	26,48	,352•9
6,84	,680•8	,91•6	-16,99	,269•9	10,13	,324•9	,17•7	29,28	,351•9
6,92	,768•8	,90•6	-14,37	,275•9	10,21	,335•9	,18•7	31,36	,350•9
6,98	,847•8	,86•6	-11,96	,280•9	10,29	,339•9	,18•7	32,61	,349•9
7,07	,932•8	,11•7	-9,89	,285•9	10,37	,341•9	,18•7	33,26	,348•9
7,12	,100•9	,12•7	-8,13	,289•9	10,44	,342•9	,19•7	33,56	,347•9
7,21	,110•9	,12•7	-5,91	,294•9	10,50	,341•9	,19•7	33,65	,346•9
7,27	,117•9	,11•7	-4,37	,298•9	10,58	,340•9	,19•7	33,76	,345•9
7,35	,126•9	,12•7	-2,71	,302•9	10,65	,340•9	,20•7	33,97	,343•9
7,42	,135•9	,12•7	-,72	,306•9	10,73	,340•9	,20•7	34,11	,342•9
7,49	,146•9	,11•7	1,53	,310•9	10,80	,338•9	,20•7	34,13	,340•9
7,55	,156•9	,11•7	3,53	,313•9	10,88	,337•9	,21•7	34,19	,339•9
7,62	,160•9	,10•7	3,89	,317•9	10,97	,336•9	,20•7	34,29	,337•9
7,70	,165•9	,92•6	4,38	,320•9	11,03	,334•9	,20•7	34,27	,336•9
7,78	,172•9	,77•6	5,26	,323•9	11,11	,333•9	,20•7	34,27	,334•9
7,84	,175•9	,66•6	5,51	,326•9	11,18	,331•9	,20•7	34,32	,333•9
7,92	,184•9	,58•6	6,90	,329•9	11,25	,330•9	,21•7	34,32	,331•9
7,99	,205•9	,75•6	11,33	,332•9	11,33	,328•9	,21•7	34,26	,329•9
8,06	,233•9	,12•7	16,54	,335•9	11,40	,326•9	,22•7	34,25	,327•9
8,13	,257•9	,14•7	20,86	,337•9	11,48	,324•9	,22•7	34,21	,326•9
8,21	,282•9	,17•7	25,00	,339•9	11,53	,322•9	,22•7	34,16	,324•9
8,29	,303•9	,20•7	28,26	,341•9	11,61	,321•9	,21•7	34,18	,322•9
8,36	,315•9	,22•7	29,95	,343•9	11,66	,319•9	,21•7	34,02	,321•9
8,44	,320•9	,20•7	30,45	,345•9	11,75	,315•9	,20•7	33,75	,319•9
8,52	,324•9	,19•7	30,75	,347•9	11,81	,313•9	,20•7	33,66	,317•9
8,59	,328•9	,19•7	31,20	,349•9	11,88	,312•9	,20•7	33,68	,315•9
8,67	,330•9	,16•7	31,28	,350•9	11,96	,310•9	,21•7	33,77	,313•9
8,75	,331•9	,14•7	31,28	,351•9	12,03	,310•9	,22•7	34,13	,312•9
8,83	,334•9	,16•7	31,52	,352•9	12,10	,309•9	,22•7	34,52	,310•9
8,96	,337•9	,17•7	31,80	,353•9	12,17	,308•9	,22•7	34,69	,308•9
8,98	,337•9	,17•7	31,82	,354•9	12,24	,306•9	,21•7	34,66	,306•9
9,06	,338•9	,17•7	31,78	,354•9	12,30	,303•9	,20•7	34,45	,304•9
9,13	,338•9	,17•7	31,81	,355•9	12,38	,299•9	,19•7	33,98	,302•9
9,22	,338•9	,17•7	31,67	,355•9	12,45	,295•9	,18•7	33,24	,300•9
9,28	,336•9	,17•7	31,27	,355•9	12,52	,289•9	,17•7	32,02	,298•9
9,37	,330•9	,16•7	30,14	,356•9	12,59	,283•9	,17•7	30,88	,296•9
9,44	,316•9	,17•7	27,43	,356•9	12,64	,279•9	,16•7	30,28	,295•9
9,51	,299•9	,16•7	24,16	,356•9	12,72	,276•9	,15•7	30,09	,292•9
9,60	,286•9	,14•7	21,53	,355•9	12,79	,275•9	,16•7	30,18	,290•9
9,67	,274•9	,14•7	19,14	,355•9	12,85	,275•9	,15•7	30,64	,289•9
9,77	,268•9	,13•7	17,67	,354•9	12,92	,275•9	,14•7	31,16	,287•9
9,83	,272•9	,13•7	18,59	,354•9	13,00	,273•9	,14•7	31,13	,285•9

MAX TT(N) IS 34,69 AT 12,17

SPRBBT= 44,93 , SPEDET= ,9694•-2 , SP1BBT= 25,84 , RAIBBT= 42,86



N	L(N)	ET(N)
93	6.66	.603#8
94	6.70	.617#8
95	6.78	.647#8
96	6.84	.680#8
97	6.92	.768#8
98	6.98	.847#8
99	7.07	.932#8
100	7.12	.100#9
101	7.21	.110#9
102	7.27	.117#9
103	7.35	.126#9
104	7.42	.135#9
105	7.49	.146#9
106	7.55	.156#9
107	7.62	.160#9
108	7.70	.165#9
109	7.78	.172#9
110	7.84	.175#9
111	7.92	.184#9
112	7.99	.205#9
113	8.06	.233#9
114	8.13	.257#9
115	8.21	.282#9
116	8.29	.303#9
117	8.36	.315#9
118	8.44	.320#9
119	8.52	.324#9
120	8.59	.329#9
121	8.67	.330#9
122	8.75	.331#9
123	8.83	.333#9
124	8.90	.337#9
125	8.98	.337#9
126	9.06	.337#9
127	9.13	.338#9
128	9.22	.338#9
129	9.28	.336#9
130	9.37	.330#9
131	9.44	.316#9
132	9.51	.299#9
133	9.60	.286#9
134	9.67	.273#9
135	9.77	.263#9
136	9.83	.272#9
137	9.91	.284#9
138	9.96	.296#9
139	10.06	.310#9
140	10.13	.325#9
141	10.21	.333#9
142	10.29	.339#9
143	10.37	.341#9
144	10.44	.342#9
145	10.50	.341#9
146	10.58	.340#9
147	10.65	.340#9
148	10.73	.340#9
149	10.80	.338#9
150	10.88	.337#9
151	10.97	.336#9
152	11.03	.333#9
153	11.11	.333#9
154	11.18	.331#9
155	11.25	.330#9
156	11.33	.326#9
157	11.40	.326#9
158	11.48	.324#9
159	11.53	.322#9
160	11.61	.321#9
161	11.66	.319#9
162	11.75	.315#9
163	11.81	.313#9
164	11.88	.312#9
165	11.96	.310#9
166	12.03	.310#9
167	12.10	.309#9
168	12.17	.306#9
169	12.24	.306#9
170	12.30	.306#9
171	12.34	.299#9
172	12.45	.295#9
173	12.52	.283#9
174	12.58	.263#9
175	12.64	.259#9
176	12.72	.276#9
177	12.79	.275#9
178	12.85	.274#9
179	12.92	.274#9
180	13.00	.273#9
N	L(N)	ET(N)

Figure 4.1.14.1 Target emittance--Qal-NNL (Site 12)

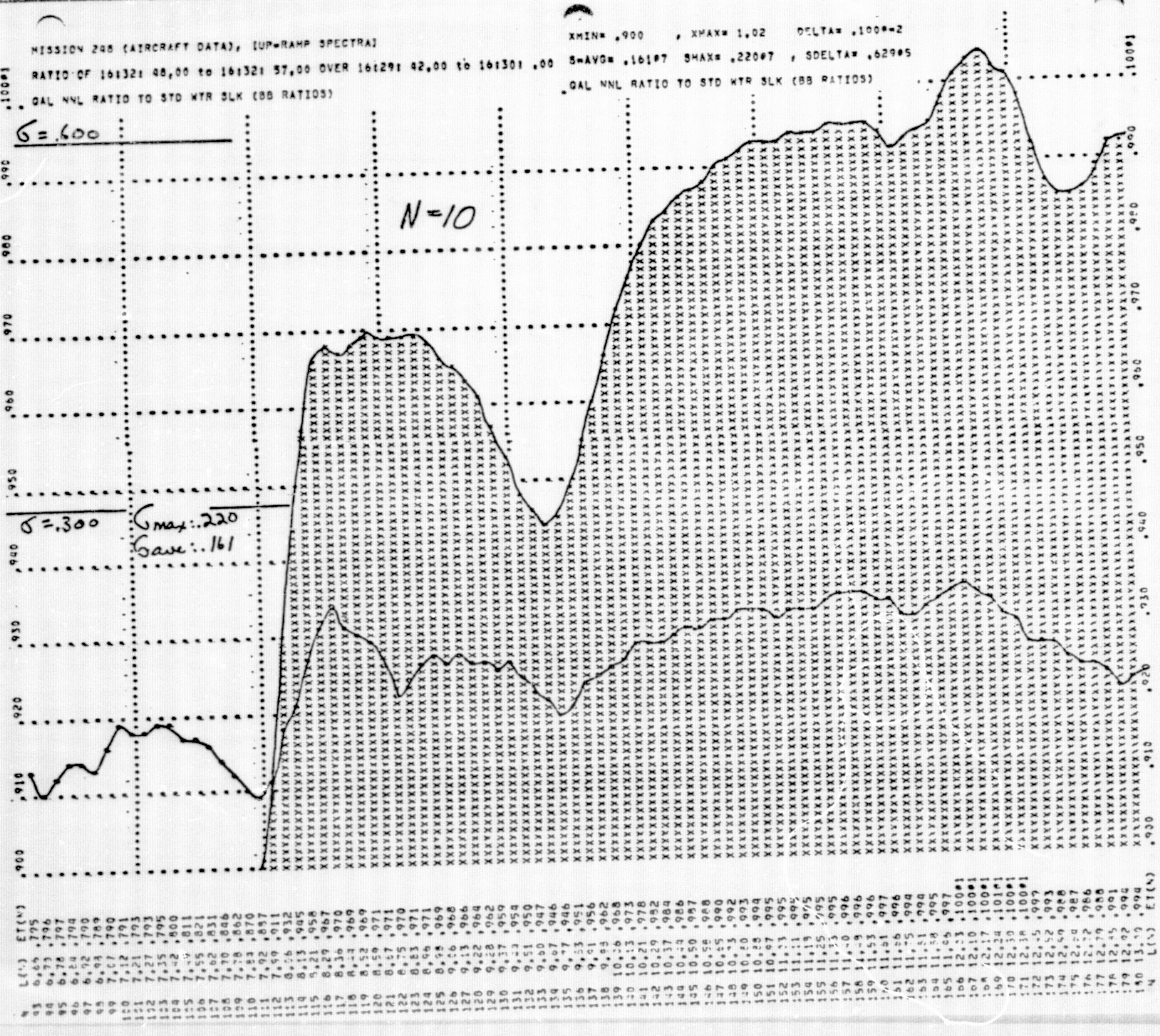


Figure 4.1.14.2 Target ratio--Qal-NNL (Site 12)

3

Table 4.1.15 Trl (Luning seds) (Site 13)

13:15 THU 10 APR 75 Page 1 <EWBUD1>SRL.15

STANFORD REMOTE SENSING LABORATORIES

MISSION 248 (AIRCRAFT DATA), (UP-RAMP SPECTRA)

TRL (Luning)

From 16:33: 4.00 to 16:33: 6.00

2 spectra averaged

L(N)	ET(N)	SDEV	TT(N)	BB(N)	L(N)	ET(N)	SDEV	TT(N)	BB(N)
6.66	.607*8	.00	-17.79	.250*9	9.91	.279*9	.00	20.00	.348*9
6.70	.623*8	.00	-17.76	.253*9	9.98	.291*9	.00	22.50	.347*9
6.78	[illegible]	.00	-17.60	.259*9	10.06	.304*9	.00	25.32	.346*9
6.84	.683*8	.00	-16.87	.263*9	10.13	.318*9	.00	28.09	.346*9
6.92	.770*8	.00	-14.25	.267*9	10.21	.328*9	.00	30.21	.345*9
6.98	.845*8	.00	-12.04	.273*9	10.29	.333*9	.00	31.42	.344*9
7.07	.932*8	.00	-9.90	.279*9	10.37	.335*9	.00	32.07	.343*9
7.12	.100*9	.00	-8.08	.283*9	10.44	.336*9	.00	32.41	.342*9
7.21	.110*9	.00	-6.03	.288*9	10.50	.336*9	.00	32.53	.341*9
7.27	.117*9	.00	-4.43	.292*9	10.58	.335*9	.00	32.63	.339*9
7.35	.126*9	.00	-2.65	.296*9	10.65	.335*9	.00	32.86	.338*9
7.42	.135*9	.00	-.76	.300*9	10.73	.334*9	.00	32.99	.337*9
7.49	.146*9	.00	1.44	.304*9	10.80	.333*9	.00	33.00	.336*9
7.55	.156*9	.00	3.43	.307*9	10.88	.332*9	.00	33.03	.334*9
7.62	.160*9	.00	3.74	.310*9	10.97	.330*9	.00	33.10	.332*9
7.70	.164*9	.00	4.18	.314*9	11.03	.329*9	.00	33.07	.331*9
7.78	.171*9	.00	5.05	.317*9	11.11	.327*9	.00	33.12	.329*9
7.84	.174*9	.00	5.34	.320*9	11.18	.326*9	.00	33.14	.328*9
7.92	.187*9	.00	6.62	.323*9	11.25	.324*9	.00	33.12	.326*9
7.99	.203*9	.00	10.86	.325*9	11.33	.322*9	.00	33.07	.325*9
8.06	.230*9	.00	15.93	.328*9	11.40	.321*9	.00	33.05	.323*9
8.13	.253*9	.00	20.14	.330*9	11.48	.319*9	.00	32.97	.321*9
8.21	.278*9	.00	24.19	.333*9	11.53	.317*9	.00	32.95	.320*9
8.29	.298*9	.00	27.44	.335*9	11.61	.316*9	.00	33.01	.318*9
8.36	.310*9	.00	29.17	.337*9	11.66	.314*9	.00	32.89	.317*9
8.44	.315*9	.00	29.65	.339*9	11.75	.311*9	.00	32.67	.315*9
8.52	[illegible]	.00	29.92	.341*9	11.81	.309*9	.00	32.62	.313*9
8.59	.322*9	.00	30.32	.342*9	11.88	.309*9	.00	32.67	.311*9
8.67	.324*9	.00	30.39	.343*9	11.96	.306*9	.00	32.77	.309*9
8.75	.325*9	.00	30.35	.345*9	12.03	.305*9	.00	33.08	.307*9
8.83	.328*9	.00	30.50	.346*9	12.10	.305*9	.00	33.44	.305*9
8.96	.331*9	.00	30.73	.347*9	12.17	.304*9	.00	33.65	.304*9
8.98	.331*9	.00	30.66	.348*9	12.24	.302*9	.00	33.66	.302*9
9.06	.331*9	.00	30.51	.348*9	12.30	.300*9	.00	33.48	.300*9
9.13	.330*9	.00	30.40	.349*9	12.38	.296*9	.00	33.09	.298*9
9.22	.330*9	.00	30.24	.349*9	12.45	.292*9	.00	32.41	.296*9
9.28	.328*9	.00	29.73	.349*9	12.52	.286*9	.00	31.23	.294*9
9.37	.322*9	.00	28.62	.350*9	12.59	.280*9	.00	30.10	.292*9
9.44	.308*9	.00	26.02	.350*9	12.64	.276*9	.00	29.49	.291*9
9.51	.293*9	.00	22.93	.350*9	12.72	.277*9	.00	29.30	.289*9
9.60	.280*9	.00	20.40	.350*9	12.79	.272*9	.00	29.37	.287*9
9.67	.270*9	.00	19.17	.349*9	12.85	.272*9	.00	29.81	.285*9
9.77	.264*9	.00	16.77	.349*9	12.92	.272*9	.00	30.32	.283*9
9.83	.268*9	.00	17.62	.348*9	13.00	.270*9	.00	30.32	.281*9

MAX TT(N) IS 33.66 AT 12.24

SPRBBT= 44.96 , SPEDET= .953*-2 , SPIDBT= 25.86 , HAIBBT= 42.81

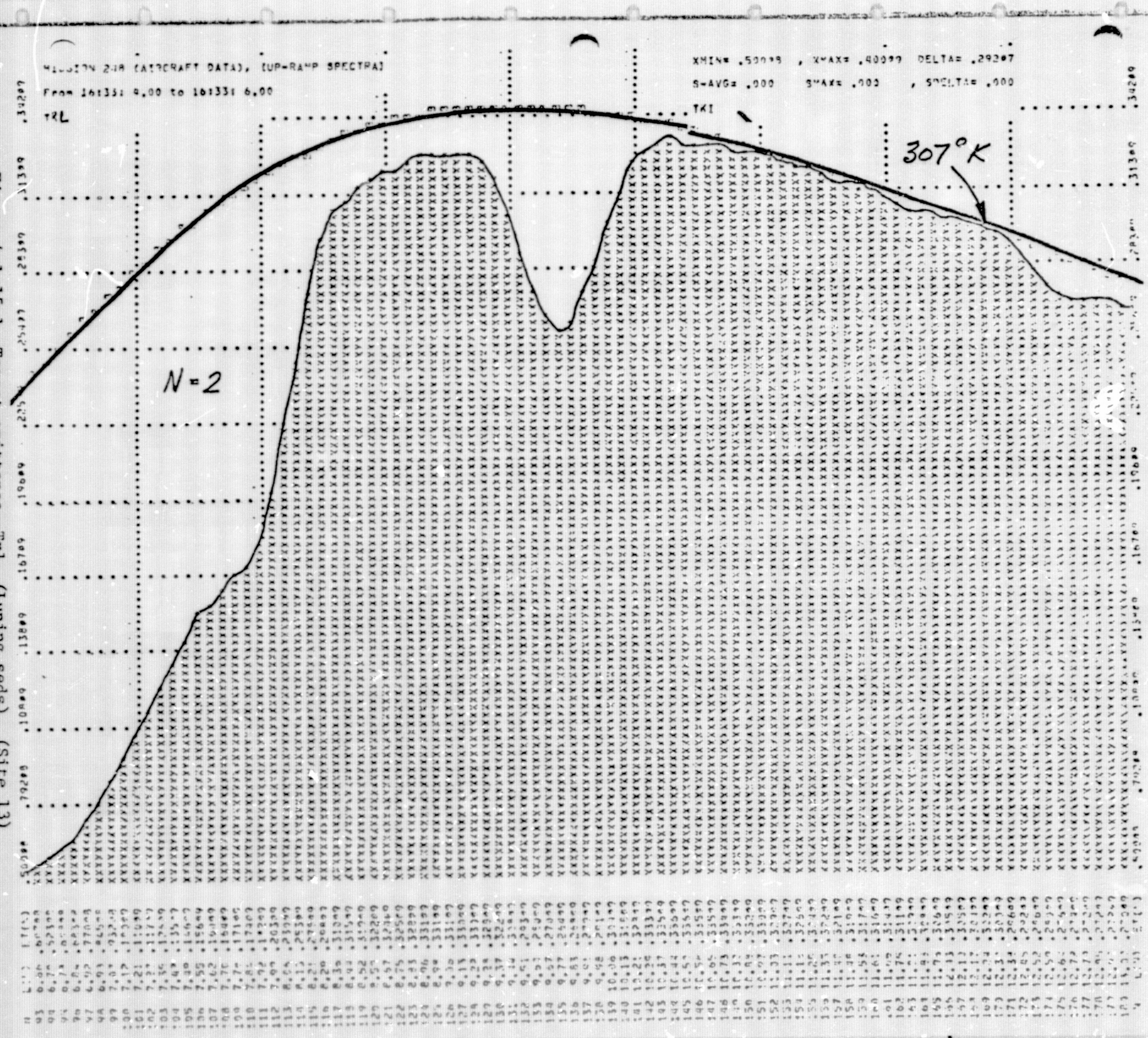


Figure 4.1.15.1 Target emittance--Trl (Luning seds) (Site 13)

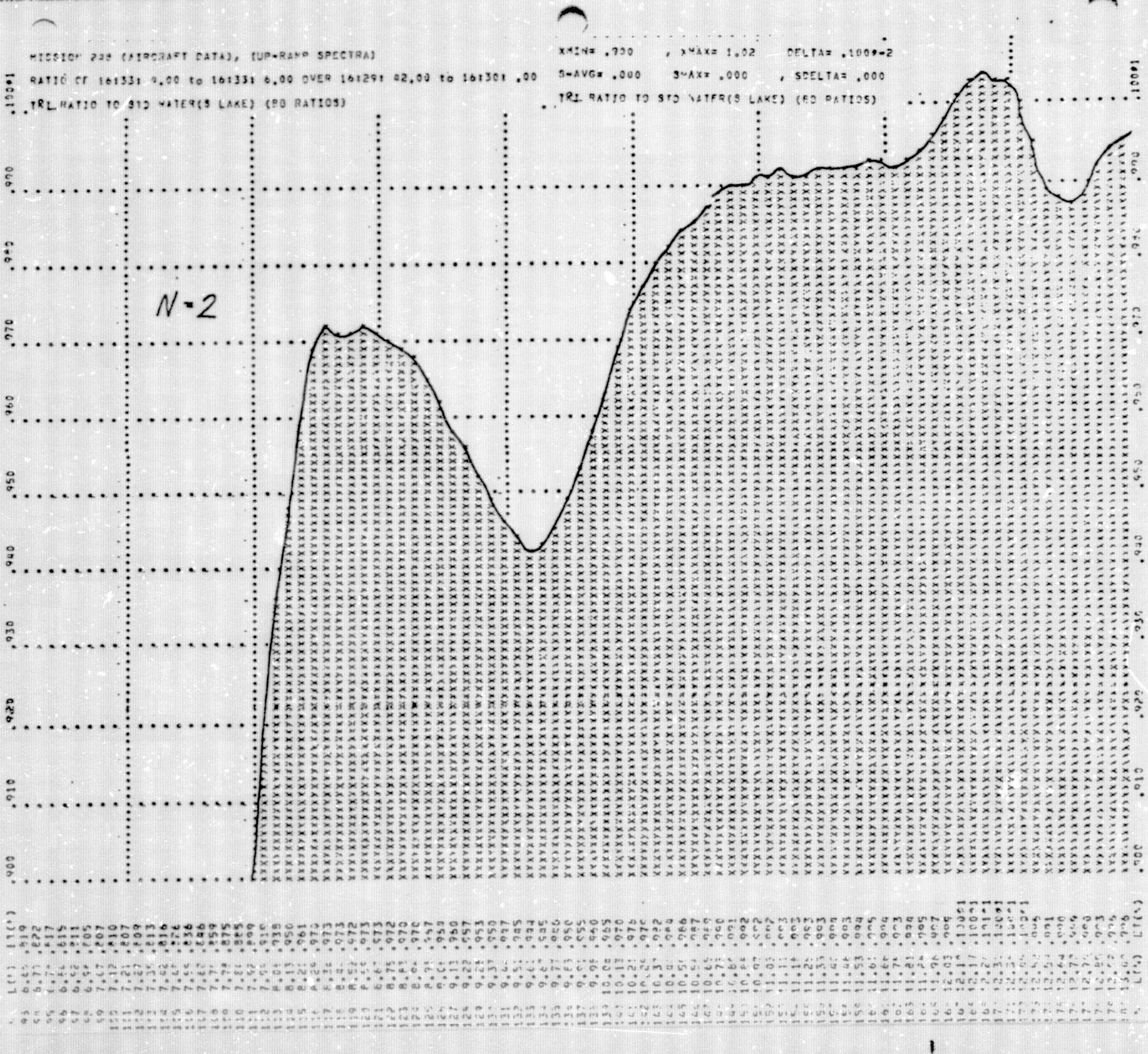


Figure 4.1.15.2 Target ratio --Tr1 (Luning seds) (Site 13)

Table 4.1.16 Garfield Flat (playa) (Site 14)

STANFORD REMOTE SENSING LABORATORIES

MISSION 248 (AIRCRAFT DATA), (UP-RAMP SPECTRA)

GARFIELD FLAT

From 16:33: 48,00 to 16:33: 53,00

6 spectra averaged

L(N)	ET(N)	SDEV	TT(N)	BB(N)	L(N)	ET(N)	SDEV	TT(N)	BB(N)
6,66	,611#8	,89#6	-17,59	,248#9	9.91	,269#9	.11#7	17.97	.346#9
6,70	,629#8	,63#6	-17,43	,251#9	9.98	,281#9	.12#7	20.47	.345#9
6,78	,659#8	,32#6	-17,06	,257#9	10.06	,294#9	.14#7	23.27	.344#9
6,84	,693#8	,37#6	-16,41	,261#9	10.13	,307#9	.17#7	25.99	.344#9
6,92	,780#8	,56#6	-13,85	,267#9	10.21	,317#9	.17#7	28.10	.343#9
6,98	,858#8	,99#6	-11,54	,271#9	10.29	,323#9	.18#7	29.45	.342#9
7,07	,937#8	,11#7	-9,72	,276#9	10.37	,326#9	,20#7	30.26	.341#9
7,12	,100#9	,93#6	-8,11	,280#9	10.44	,328#9	,21#7	30.74	.340#9
7,21	,110#9	,57#6	-6,00	,286#9	10.50	,328#9	,22#7	31.01	.339#9
7,27	,117#9	,50#6	-4,49	,289#9	10.58	,328#9	,24#7	31.26	.337#9
7,35	,125#9	,95#6	-2,82	,293#9	10.65	,328#9	,25#7	31.57	.336#9
7,42	,135#9	,96#6	-,76	,297#9	10.73	.328#9	,26#7	31.79	.335#9
7,49	,146#9	,92#6	1,46	,301#9	10.80	,328#9	,28#7	31.89	.334#9
7,55	,155#9	,10#7	3,36	,304#9	10.88	.327#9	.27#7	32.03	.332#9
7,62	,159#9	,10#7	3,64	,308#9	10.97	,326#9	,29#7	32.18	.330#9
7,70	,164#9	,11#7	4,06	,311#9	11.03	,325#9	.29#7	32.22	,329#9
7,78	,170#9	,11#7	4,84	,314#9	11.11	,324#9	,29#7	32.30	.327#9
7,84	,173#9	,11#7	5,08	,317#9	11.18	.323#9	,29#7	32.40	.326#9
7,92	,182#9	,16#7	6,43	,320#9	11.25	.321#9	.28#7	32.40	.324#9
7,99	,202#9	,20#7	10,65	,323#9	11.33	,319#9	,28#7	32.37	,323#9
8,06	,229#9	,26#7	15,64	,326#9	11.40	,318#9	.31#7	32.38	,321#9
8,13	,252#9	,31#7	19,83	,328#9	11.48	,316#9	.30#7	32.34	,319#9
8,21	,276#9	,35#7	23,81	,330#9	11.53	,314#9	.29#7	32.31	,318#9
8,29	,296#9	,37#7	26,95	,332#9	11.61	,313#9	.30#7	32.41	.316#9
8,36	,307#9	,37#7	28,60	,334#9	11.66	.312#9	,29#7	32.33	.315#9
8,44	,312#9	,34#7	29,09	,336#9	11.75	,309#9	.27#7	32.12	.313#9
8,52	,315#9	,32#7	29,28	,338#9	11.81	,307#9	.28#7	32.10	,311#9
8,59	,318#9	,31#7	29,61	,339#9	11.88	,306#9	,28#7	32,20	,310#9
8,67	,320#9	,31#7	29,57	,341#9	11.96	,304#9	,27#7	32.30	.308#9
8,75	,320#9	,29#7	29,43	,342#9	12,03	,304#9	,26#7	32,65	,306#9
8,83	,322#9	,28#7	29,50	,343#9	12,10	,303#9	,25#7	33,04	,304#9
8,96	,324#9	,26#7	29,61	,345#9	12,17	,302#9	,25#7	33,25	,302#9
8,98	,324#9	,23#7	29,46	,345#9	12,24	,301#9	,25#7	33,23	,300#9
9,06	,323#9	,21#7	29,24	,346#9	12,30	,298#9	,25#7	33,05	,299#9
9,13	,323#9	,20#7	29,06	,346#9	12,38	,295#9	,25#7	32,67	,296#9
9,22	,322#9	,20#7	28,71	,347#9	12,45	,290#9	,23#7	32,02	,295#9
9,28	,319#9	,20#7	28,09	,347#9	12,52	,284#9	,21#7	30,87	,293#9
9,37	,312#9	,18#7	26,84	,347#9	12,59	,279#9	,20#7	29,79	,291#9
9,44	,298#9	,16#7	24,15	,347#9	12,64	,275#9	,19#7	29,24	,289#9
9,51	,283#9	,15#7	20,95	,347#9	12,72	,273#9	,18#7	29,04	,287#9
9,60	,270#9	,12#7	18,36	,347#9	12,79	,271#9	,19#7	29,09	,285#9
9,67	,260#9	,99#6	16,10	,347#9	12,85	,271#9	,21#7	29,50	,284#9
9,77	,259#9	,94#6	14,75	,347#9	12,92	,271#9	,21#7	30,01	,282#9
9,83	,250#9	,97#6	15,63	,346#9	13,00	,269#9	,20#7	29,98	,280#9

MAX TT(N) IS 33,25 AT 12,17

SPRBBT= 44,93 , SPEDET= ,9565#-2 , SPIBBT= 25,35 , RAIBBT= 42,72

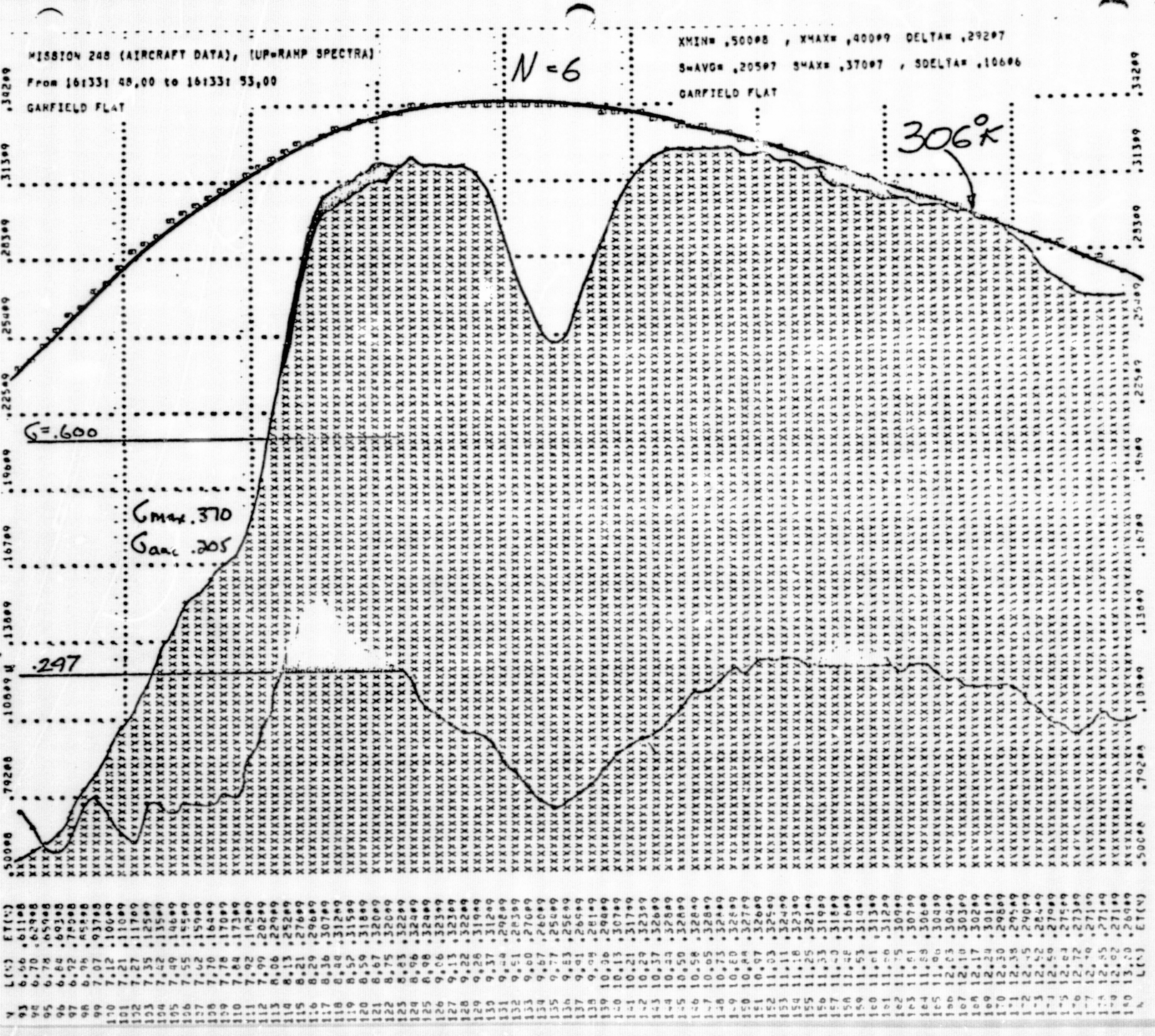


Figure 4.1.16.1 Target emittance-- Garfield Flat (Site 14)

MISSION 248 (AIRCRAFT DATA), (UP-RAMP SPECTRA)
RATIO OF 16:33: 48,00 to 16:33: 53,00 OVER 16:29: 42,00 to 16:30: ,00
GARFIELD FLAT RATIO TO STD WTR SLK (BB RATIOS)

XMIN= .900 , XMAX= 1.02 DELTA= .100#-2
S-AVG= .205#7 SMAX= .370#7 , SDELTA= .106#6
GARFIELD FLAT RATIO TO STD WTR SLK (BB RATIOS)

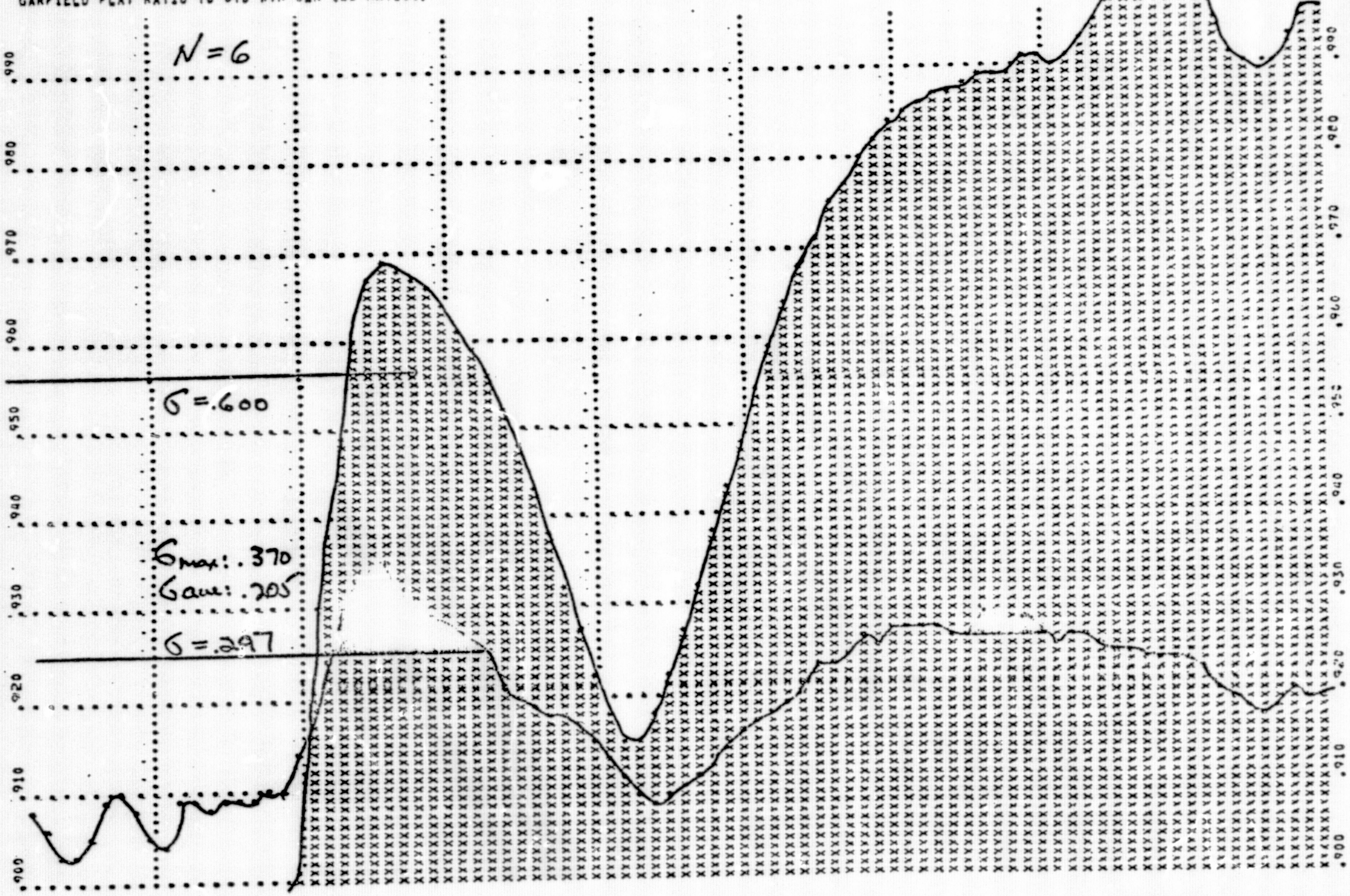


Figure 4.1.16.2 Target ratio—Garfield Flat (Site 14)

N	L(I)	ET(N)
93	6.66	.832
94	6.73	.839
95	6.74	.839
96	6.84	.835
97	6.92	.829
98	6.98	.824
99	7.07	.819
100	7.12	.817
101	7.21	.815
102	7.27	.815
103	7.35	.816
104	7.42	.823
105	7.49	.834
106	7.55	.842
107	7.62	.850
108	7.70	.864
109	7.74	.878
110	7.84	.886
111	7.92	.902
112	7.99	.922
113	8.06	.934
114	8.13	.951
115	8.21	.961
116	8.29	.968
117	8.36	.970
118	8.44	.970
119	8.52	.968
120	8.59	.968
121	8.67	.965
122	8.75	.963
123	8.83	.960
124	8.96	.958
125	8.98	.953
126	9.06	.949
127	9.13	.944
128	9.22	.939
129	9.28	.934
130	9.37	.928
131	9.44	.923
132	9.51	.919
133	9.60	.917
134	9.67	.917
135	9.77	.919
136	9.83	.923
137	9.91	.928
138	9.98	.934
139	10.06	.939
140	10.13	.945
141	10.21	.950
142	10.29	.956
143	10.37	.961
144	10.44	.965
145	10.50	.970
146	10.58	.973
147	10.65	.976
148	10.73	.979
149	10.80	.981
150	10.88	.983
151	10.97	.985
152	11.03	.986
153	11.11	.987
154	11.18	.988
155	11.25	.989
156	11.33	.990
157	11.40	.990
158	11.48	.990
159	11.53	.991
160	11.61	.992
161	11.66	.992
162	11.75	.991
163	11.81	.993
164	11.89	.995
165	11.96	.996
166	12.03	.999
167	12.10	.100#1
168	12.17	.101#1
169	12.24	.101#1
170	12.30	.100#1
171	12.38	.100#1
172	12.45	.100#1
173	12.52	.997
174	12.59	.992
175	12.64	.991
176	12.72	.992
177	12.79	.991
178	12.85	.992
179	12.92	.997
180	13.00	.997
N	L(N)	ET(N)

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OF POOR QUALITY

Table 4.1.17 Gabbs Playa (Site 15) (see Fig 2.1)

13:17 THU 10 APR 75 Page 1 <EWBUDI>SRL.;3

STANFORD REMOTE SENSING LABORATORIES

MISSION 248 (AIRCRAFT DATA), (UP-RAMP SPECTRA)

PLAYA MRGS Gabbs Playa

From 16:9: 35.00 to 16:9: 43.00

9 spectra averaged

L(N)	ET(N)	SDEV	TT(N)	BB(N)	L(N)	ET(N)	SDEV	TT(N)	BB(N)
6.66	.430#8	.14#7	-27.76	.214#9	9.91	.251#9	.76#6	13.95	.313#9
6.70	.441#9	.12#7	-27.87	.217#9	9.98	.263#9	.66#6	16.47	.313#9
6.78	.464#8	.11#7	-27.49	.222#9	10.06	.275#9	.61#6	19.27	.312#9
6.84	.496#8	.12#7	-26.51	.226#9	10.13	.289#9	.52#6	22.03	.312#9
6.92	.592#8	.84#6	-22.89	.232#9	10.21	.298#9	.46#6	24.13	.311#9
6.98	.664#8	.85#6	-19.77	.236#9	10.29	.303#9	.62#6	25.38	.311#9
7.07	.748#8	.13#7	-17.16	.241#9	10.37	.306#9	.76#6	26.05	.310#9
7.12	.822#8	.13#7	-14.88	.244#9	10.44	.306#9	.88#6	26.35	.309#9
7.21	.915#8	.14#7	-12.40	.250#9	10.50	.306#9	.97#6	26.45	.309#9
7.27	.986#8	.15#7	-10.57	.253#9	10.58	.306#9	.94#6	26.56	.308#9
7.35	.107#9	.16#7	-8.64	.257#9	10.65	.305#9	.94#6	26.71	.307#9
7.42	.116#9	.14#7	-6.49	.261#9	10.73	.305#9	.84#6	26.86	.306#9
7.49	.126#9	.10#7	-4.12	.265#9	10.80	.304#9	.88#6	26.86	.305#9
7.55	.135#9	.89#6	-2.05	.267#9	10.88	.303#9	.81#6	26.91	.304#9
7.62	.139#9	.96#6	-1.99	.271#9	10.97	.302#9	.75#6	26.99	.302#9
7.70	.142#9	.81#6	-1.65	.274#9	11.03	.301#9	.76#6	26.95	.301#9
7.78	.147#9	.68#6	-1.08	.278#9	11.11	.300#9	.72#6	26.94	.300#9
7.84	.150#9	.51#6	-.95	.280#9	11.18	.299#9	.78#6	26.96	.299#9
7.92	.157#9	.74#6	.20	.283#9	11.25	.297#9	.90#6	26.93	.297#9
7.99	.175#9	.78#6	4.43	.286#9	11.33	.295#9	.89#6	26.86	.296#9
8.06	.200#9	.91#6	9.59	.289#9	11.40	.294#9	.75#6	26.80	.295#9
8.13	.223#9	.79#6	13.98	.291#9	11.48	.292#9	.74#6	26.74	.293#9
8.21	.246#9	.87#6	18.12	.293#9	11.53	.291#9	.75#6	26.71	.292#9
8.29	.265#9	.97#6	21.41	.296#9	11.61	.290#9	.70#6	26.73	.291#9
8.36	.277#9	.91#6	23.18	.298#9	11.66	.285#9	.72#6	26.62	.289#9
8.44	.282#9	.11#7	23.79	.300#9	11.75	.285#9	.67#6	26.41	.288#9
8.52	.285#9	.11#7	24.06	.302#9	11.81	.284#9	.72#6	26.29	.286#9
8.59	.289#9	.95#6	24.39	.303#9	11.88	.282#9	.62#6	26.28	.285#9
8.67	.291#9	.76#6	24.49	.305#9	11.96	.281#9	.62#6	26.33	.283#9
8.75	.292#9	.76#6	24.46	.306#9	12.03	.280#9	.60#6	26.60	.282#9
8.83	.295#9	.61#6	24.65	.308#9	12.10	.280#9	.64#6	26.91	.280#9
8.96	.298#9	.81#6	24.96	.309#9	12.17	.279#9	.59#6	27.06	.279#9
8.98	.299#9	.85#6	25.01	.310#9	12.24	.277#9	.67#6	27.05	.277#9
9.06	.300#9	.67#6	25.02	.311#9	12.30	.275#9	.63#6	26.90	.275#9
9.13	.301#9	.67#6	25.07	.311#9	12.38	.272#9	.64#6	26.50	.274#9
9.22	.301#9	.75#6	24.96	.312#9	12.45	.269#9	.57#6	25.96	.272#9
9.28	.300#9	.71#6	24.57	.313#9	12.52	.263#9	.67#6	24.90	.271#9
9.37	.295#9	.63#6	23.46	.313#9	12.59	.258#9	.65#6	23.87	.269#9
9.44	.281#9	.66#6	20.76	.313#9	12.64	.255#9	.71#6	23.33	.268#9
9.51	.266#9	.67#6	17.50	.314#9	12.72	.253#9	.79#6	23.16	.266#9
9.60	.250#9	.77#6	14.79	.314#9	12.79	.251#9	.90#6	23.20	.264#9
9.67	.243#9	.82#6	12.36	.314#9	12.85	.251#9	.89#6	23.56	.263#9
9.77	.237#9	.75#6	10.93	.314#9	12.92	.251#9	.85#6	24.01	.261#9
9.83	.240#9	.82#6	11.59	.313#9	13.00	.249#9	.89#6	23.92	.259#9

MAX TT(N) IS 27.06 AT 12.17

SPRDST= 43.96 , SPEDETx .9816#-2 , SPIBHT= 26.42 , RAIBBT= 45.69

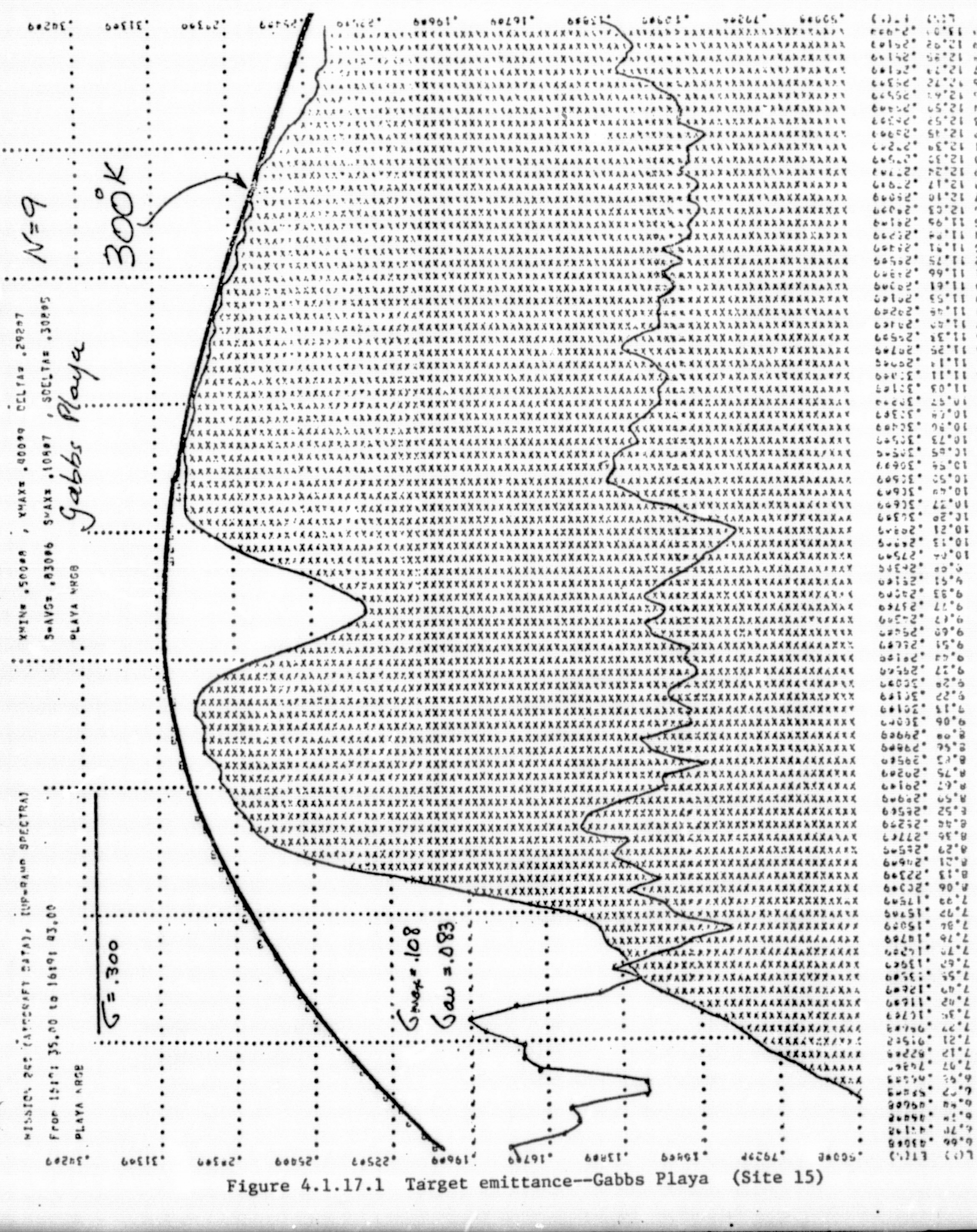


Figure 4.1.17.1 Target emittance--Gabbs Playa (Site 15)

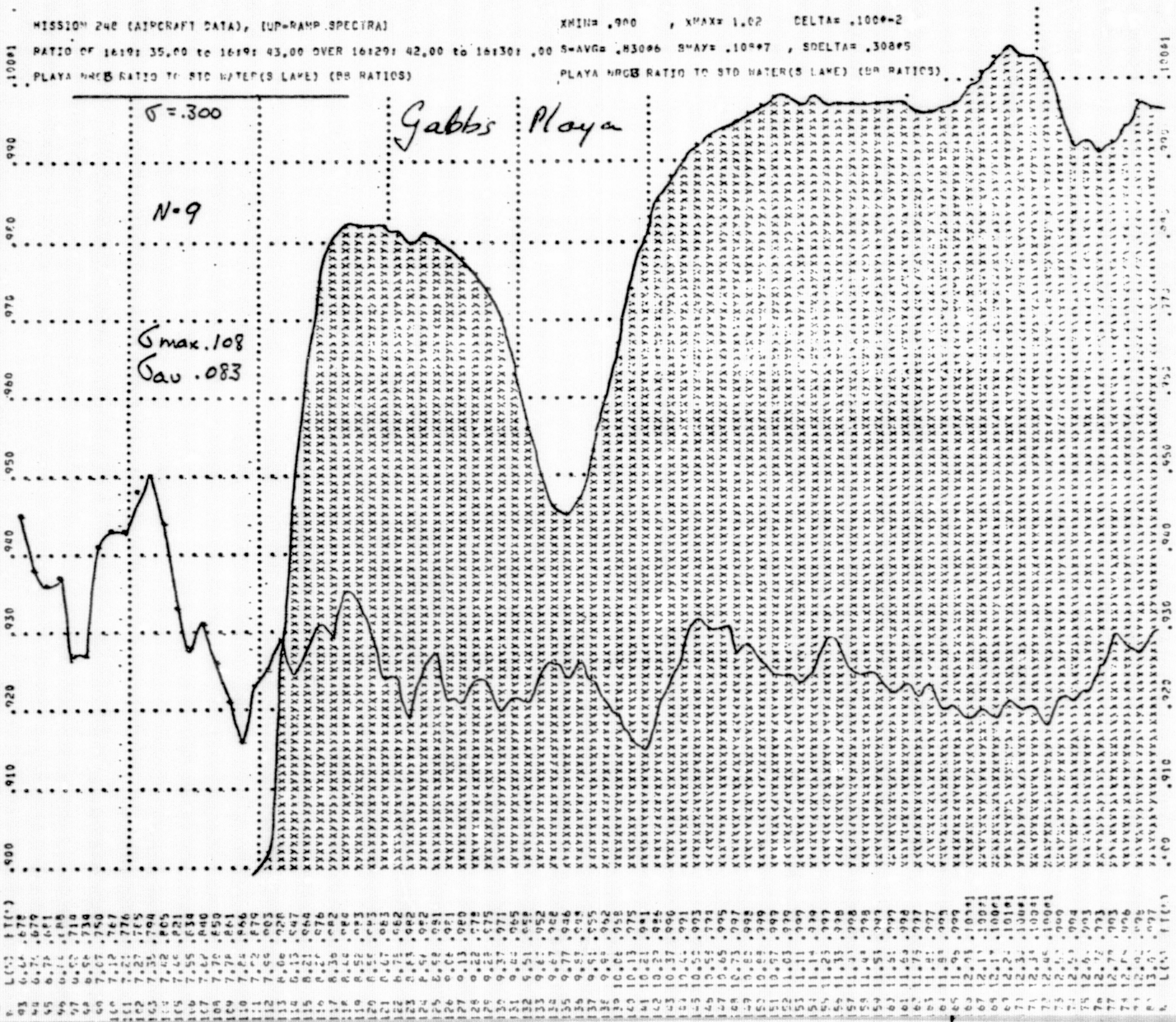


Figure 4.1.17.2 Target ratio—Gabbs Playa (Site 15)

4.1.2 Calculating Emittance of Each Target

a. The "emittance" spectra were calculated for each set, by dividing the observed radiance of each L(N) value by the calculated radiance for TT(N)MAX. These data were not plotted, as the target radiance spectra still retained atmospheric absorption (and emittance) effects. These were removed in our usual method, by dividing these "emittance" spectra by comparable ones taken over nearby water bodies. Our flight-line passed twice over Walker Lake, and from the longer section (16:29:19 to 16:30:40 GMT) we selected several sections, the best (i.e., most-even temperatures) being the South Lake group ("STD WTR"; 16:29:40 to 16:30:00); pallet radiometer temperature average 21.00 ± 0.09°; N = 21; bandpass = 13-375-12.1 μm.

b. Spectra for this section were averaged and divided by the calculated equivalent blackbody for MAXTT(N) of 295.5°K observed at 10.73 μm. (Spectrometer temperatures, averaged over the radiometer bandpass gave 22.15 ± 0.20°C, N = 22). From this we now had emittance spectra for water which also carried atmospheric effects.

4.1.3 Ratioing Target "Emittance" to Water "Emittance" to Minimize Atmospheric Effects

Target emittance spectra, "free" of the atmosphere were calculated by dividing target emittance (a) above, by water emittance (b) above, and plotted as the terrain spectra of figures 4.1.1.1 to 4.1.17.2, emphasizing, in a relative way, their non-blackbody behavior, indicative of their varying mineralogies. This was the final answer for which we were seeking.

4.2 SKYLAB S-191 Spectra

As outlined in preceeding sections only the Track 6 (NW to SE) pass of the SL3 mission was utilized for analysis, because of the absence of RB57 underflights on the other tracks and the problem of sun glint off Mono Lake for SL2. The Track 29 (SW to NE) pass over Mono Lake, was rendered inoperable by field-of-view wander on-and-off the island, and a change of S-191 target from Mono Lake to Walker Lake, before the experiment profile on Mono Lake was completed. However most of the Track 6 pass SL3, day 233 was suitable and has been analysed.

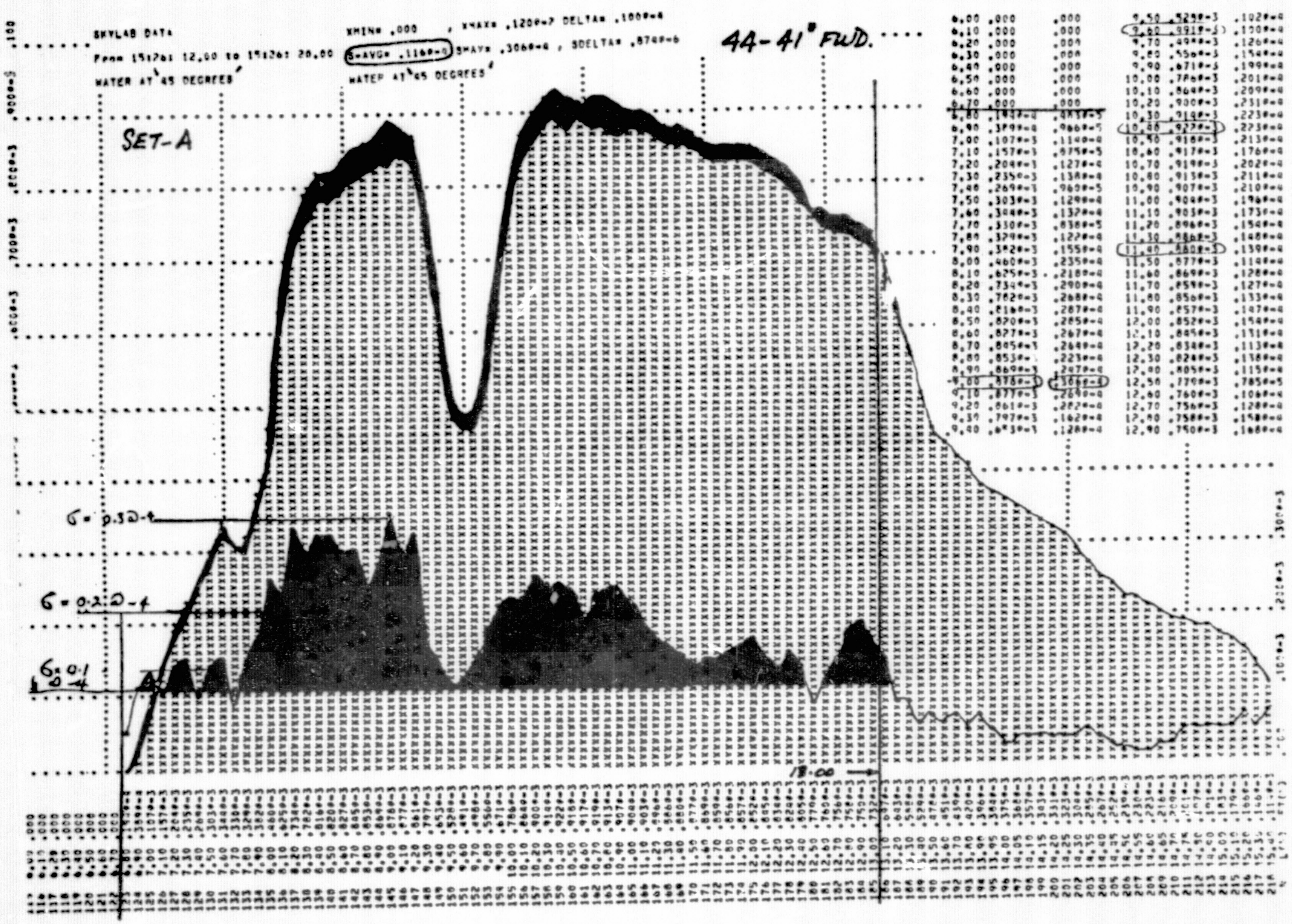
4.2.1 Forward Acquisition, Tracking and Hold on Walker Lake

A continuous recording of S-191 spectra was made from a forward view angle of about 45°, starting at 15:26:12 GMT when the spacecraft was still over northern California, until a near vertical nadir position abeam of Walker Lake at 15:27:16. During this period the air mass changed (M = secant zenith angle) from M = 1.41 to M = 1.0. The spectra have been segregated into angle-dependent groups (Sets A through E; 44 to 41; 38 to 33°; 28 to 32°; 12 to 6° and 3 to 1° views from the vehicle).

4.2.1.1 Water spectra at maximum forward view. Eight spectra have been averaged from 15:26:12 to 15:26:20 and their radiance spectrum (Set A) presented in figure 4.2.1.1.1. The black areas on the radiance curve show ±1 σ variations, which is unusually high. (See next section.) The standard deviation of each data point is also plotted at the same horizontal scale on its own along the abcissa, although the ordinate is scaled down to fit about one-third of the range (s avg = .116 @ -4; S max .306 @ -4; S delta .874 @ -6). All standard deviations above a sigma value of 0.1 @ -4 have been colored black. This high variability indicates to us that warmer land surfaces were intersected by the spectrometer and these contributed also to the higher-than-normal emittance values when these eight spectra were ratioed to those of the vertical-viewed water (fig. 4.2.1.1.2).

Because of this contamination, another set of seven spectra were chosen from 15:26:26 to 15:26:34 which represented a clearer view of the lake from a calculated 38° to 33° forward with air masses of M = 1.27 to M = 1.19. This B set showed a significantly lower standard deviation (S avg = 0.587 @ -5), roughly half of set A (S avg = 1.160 @ -5) (see fig. 4.2.1.1.3). When ratioed to the standard (vertically viewed) water (Set E) the emittance spectrum gave suitable values (fig. 4.2.1.1.4; Set B/Set E).

4.2.1.2 Water spectra at middle forward view (28°). Seven spectra were selected from 15:25:41 through 15:26:49, corresponding to views of 28 through 23° forward, and air masses of M = 1.13 to M = 1.09 (Set C) (fig. 4.2.1.2.1). The standard deviation is lower again (S avg = 0.524 @ -5) and now concentrated principally in the water vapor wing structure



L(N)	ET(N)	SDEV	L(N)	ET(N)	SDEV
6.00	.000	.000	9.50	.929E-3	.102E-4
6.10	.000	.000	9.60	.991E-3	.110E-4
6.20	.000	.000	9.70	.499E-3	.126E-4
6.30	.000	.000	9.80	.556E-3	.154E-4
6.40	.000	.000	9.90	.671E-3	.199E-4
6.50	.000	.000	10.00	.786E-3	.201E-4
6.60	.000	.000	10.10	.864E-3	.209E-4
6.70	.000	.000	10.20	.900E-3	.231E-4
6.80	.194E-4	.483E-5	10.30	.919E-3	.223E-4
6.90	.379E-4	.966E-5	10.40	.927E-3	.223E-4
7.00	.107E-3	.114E-4	10.50	.918E-3	.213E-4
7.10	.157E-3	.875E-5	10.60	.917E-3	.176E-4
7.20	.204E-3	.127E-4	10.70	.919E-3	.202E-4
7.30	.235E-3	.138E-4	10.80	.913E-3	.211E-4
7.40	.269E-3	.960E-5	10.90	.907E-3	.210E-4
7.50	.303E-3	.129E-4	11.00	.904E-3	.196E-4
7.60	.304E-3	.132E-4	11.10	.903E-3	.173E-4
7.70	.330E-3	.838E-5	11.20	.896E-3	.154E-4
7.80	.329E-3	.122E-4	11.30	.886E-3	.148E-4
7.90	.382E-3	.155E-4	11.40	.880E-3	.139E-4
8.00	.460E-3	.235E-4	11.50	.877E-3	.114E-4
8.10	.625E-3	.218E-4	11.60	.869E-3	.128E-4
8.20	.734E-3	.290E-4	11.70	.859E-3	.127E-4
8.30	.782E-3	.268E-4	11.80	.856E-3	.133E-4
8.40	.816E-3	.287E-4	11.90	.857E-3	.147E-4
8.50	.820E-3	.285E-4	12.00	.852E-3	.154E-4
8.60	.827E-3	.267E-4	12.10	.845E-3	.131E-4
8.70	.805E-3	.264E-4	12.20	.834E-3	.113E-4
8.80	.853E-3	.223E-4	12.30	.824E-3	.118E-4
8.90	.869E-3	.247E-4	12.40	.805E-3	.115E-4
9.00	.878E-3	.306E-4	12.50	.779E-3	.785E-5
9.10	.877E-3	.269E-4	12.60	.760E-3	.106E-4
9.20	.861E-3	.282E-4	12.70	.756E-3	.128E-4
9.30	.797E-3	.162E-4	12.80	.758E-3	.158E-4
9.40	.683E-3	.128E-4	12.90	.750E-3	.168E-4

Figure 4.2.1.1.1 Max forward view--45 degree (Set A) Walker Lake

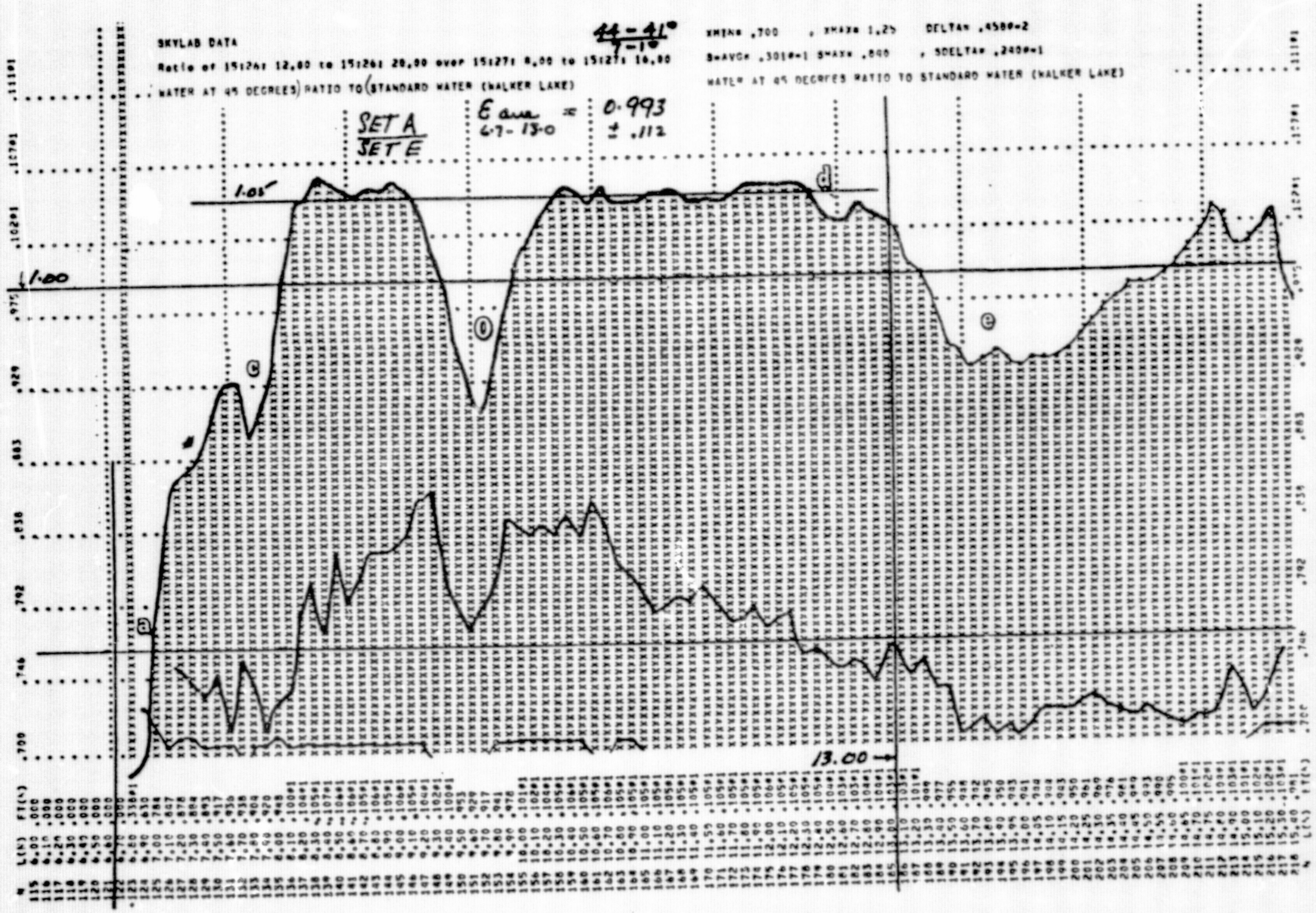


Figure 4.2.1.1.2 Ratio Set A/Set E

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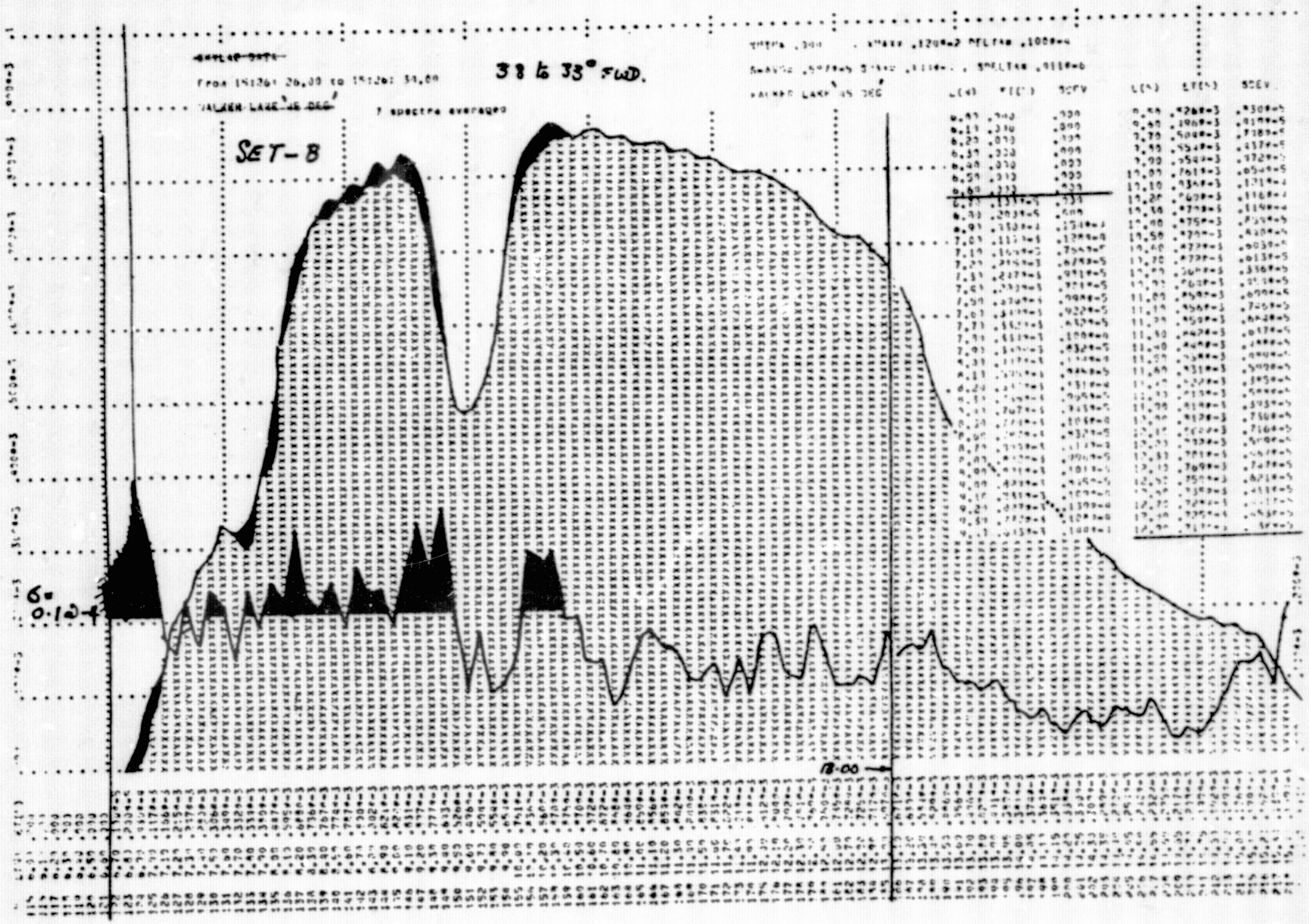

Figure 4.2.1.1.3 Water--forward view (38-33 deg) (Set B)

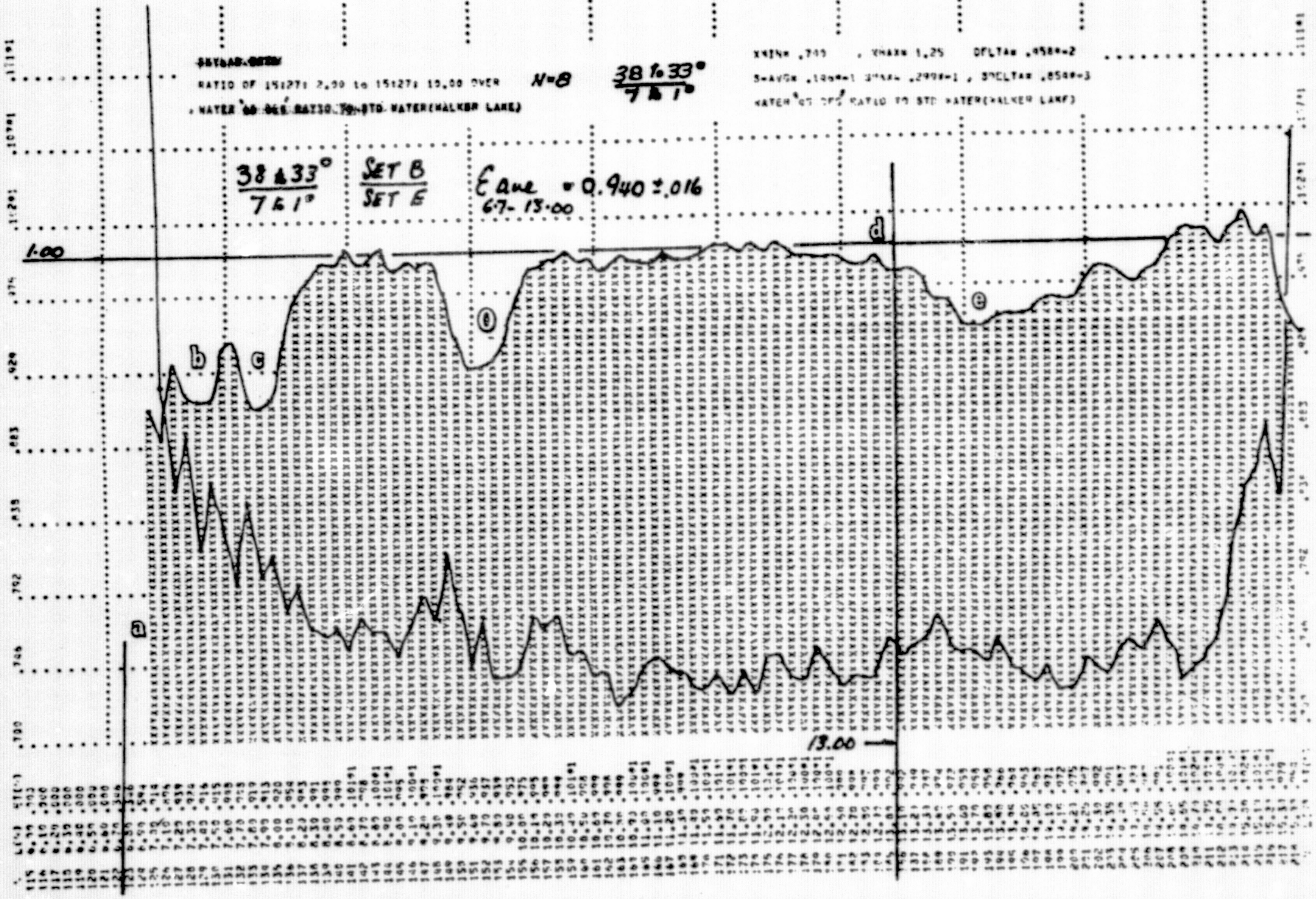

Figure 4.2.1.1.4 Ratio Set B/Set E

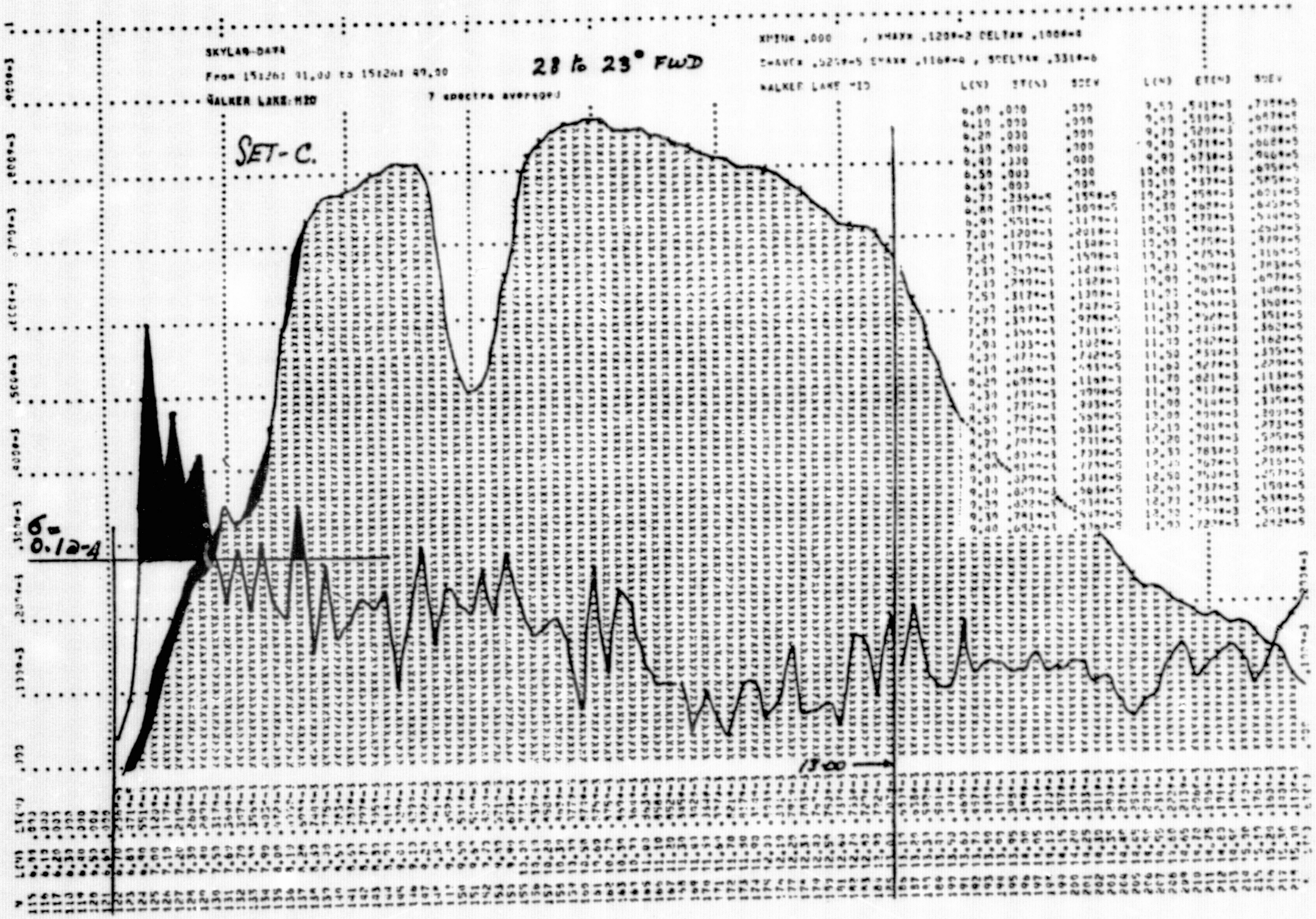

Figure 4.2.1.2.1 Water-- middle forward view (28 deg) Set C

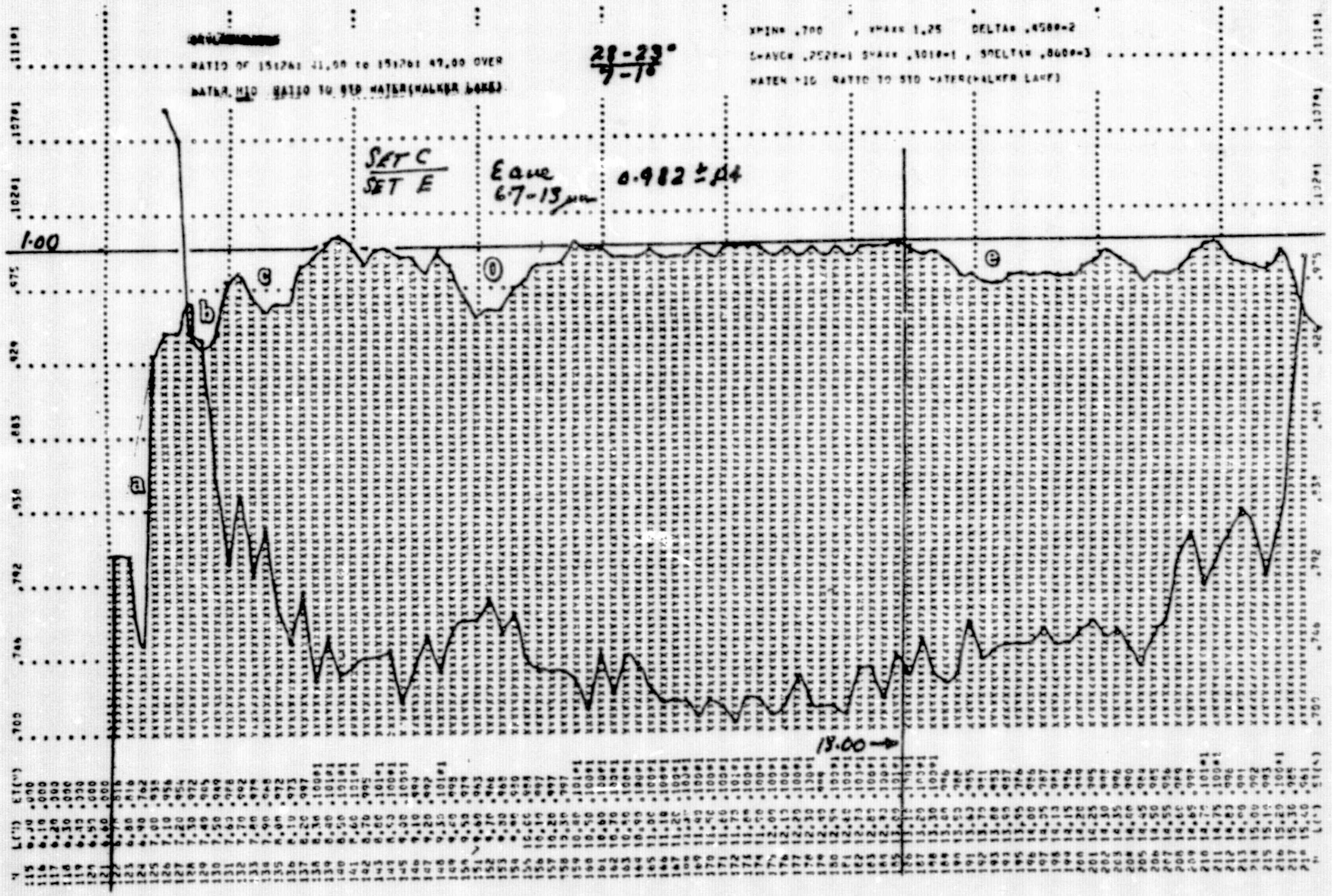

Figure 4.2.1.2.2 Ratio Set C/Set E

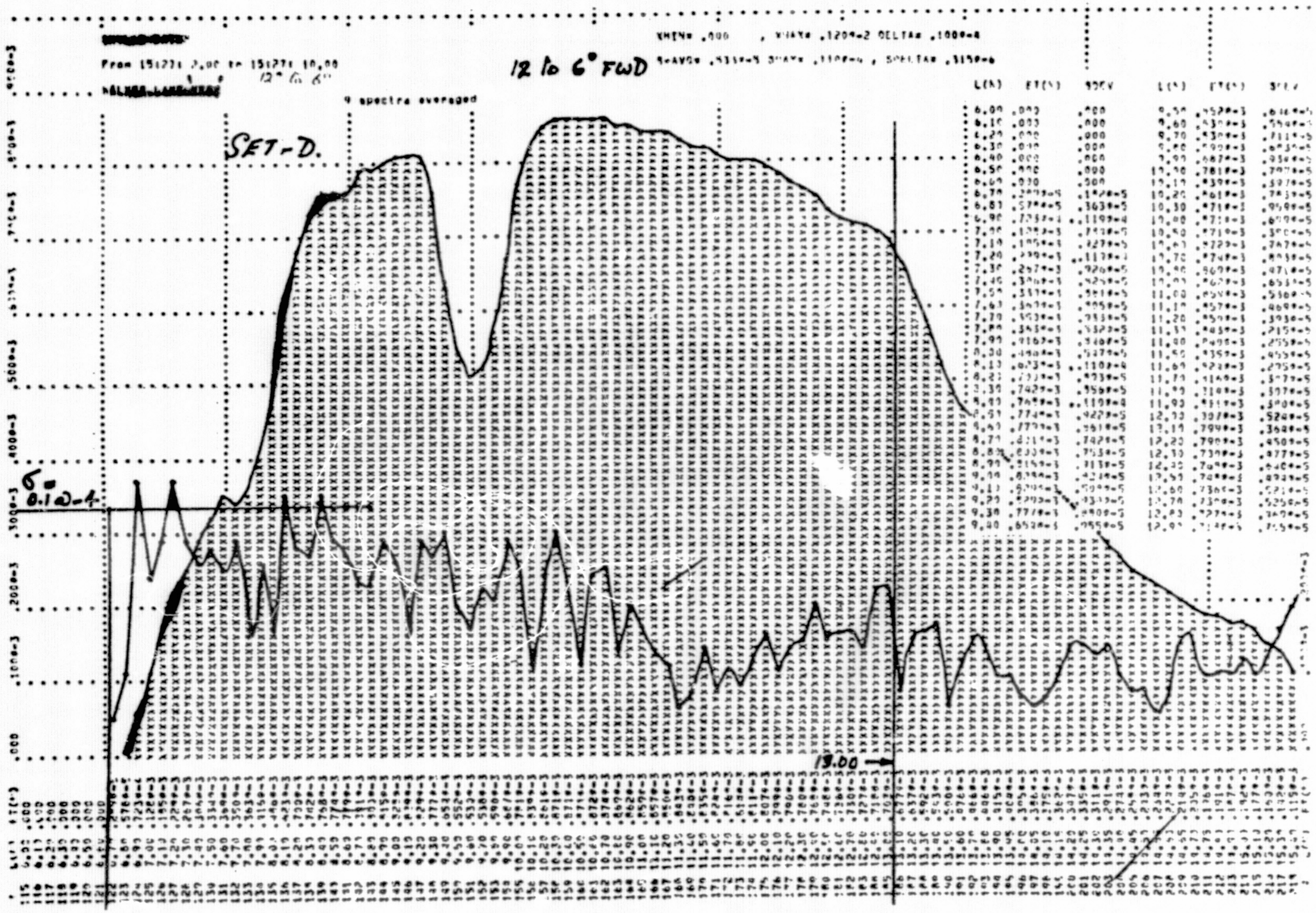

Figure 4.2.1.3.1 Water--near vertical (12-6deg) (Set D)

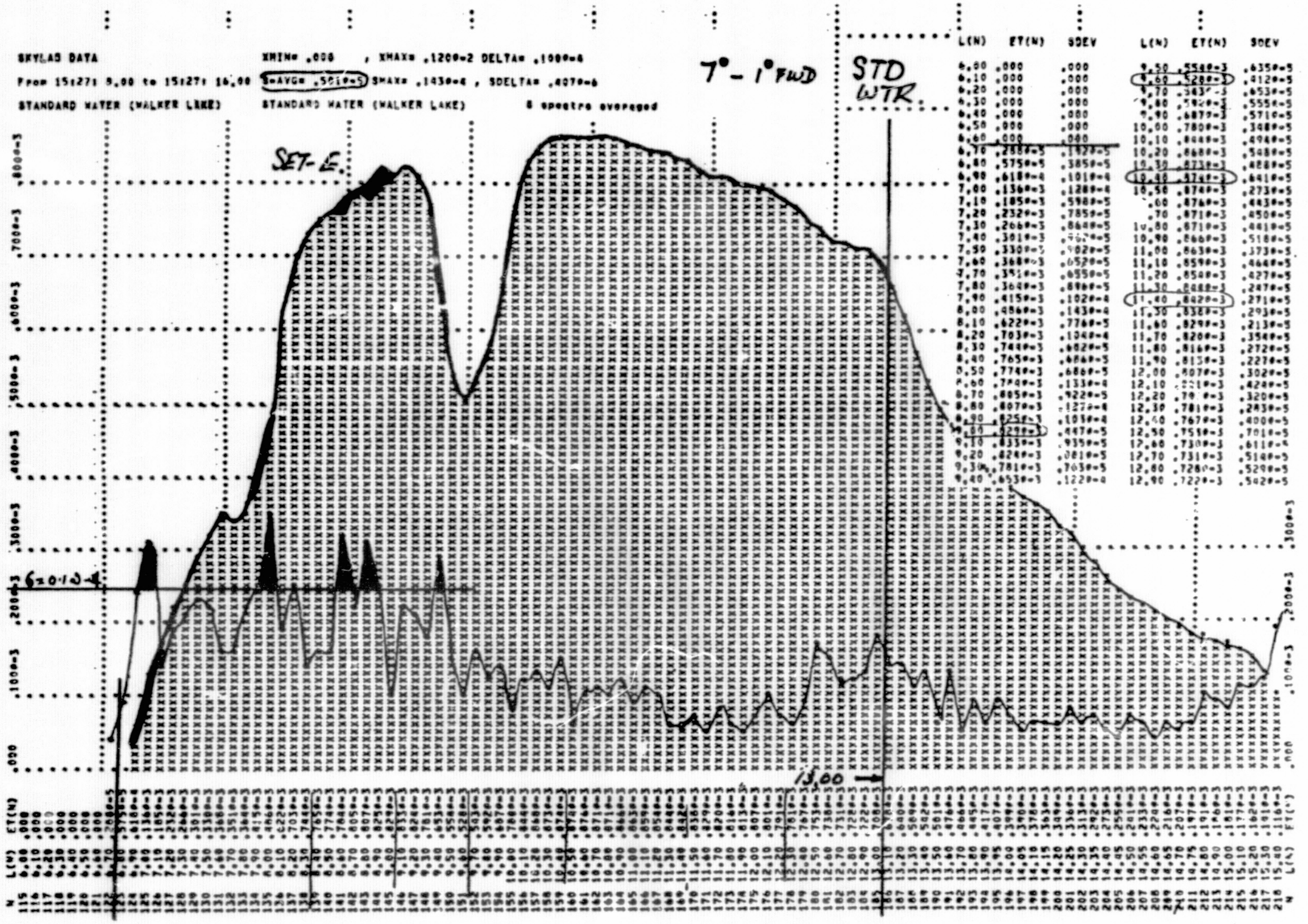

Figure 4.2.1.3.2 Water--near vertical (7-1 deg) (Set E)

SKYLAB DATA

RATIO OF 15:27: 8.00 to 15:27: 16.00 OVER

NEAR VERTICAL WALKER LAKE 12-7 DEG VIEW RATIO TO STANDARD WATER WALKER LAKE
** 7-1 DEG VIEW

XMIN=-.8680-1 , XMAX= 1.67 DELTA= .1460-1

S-AVG= .2590-1 SMAX= +.2670-1 , SDELTA= .7630-3

$\frac{SGT\,D}{SGT\,E}\left(\frac{12^\circ-7^\circ}{7^\circ-1^\circ}\right)$ $\mathcal{E}_{ave} = 0.999$

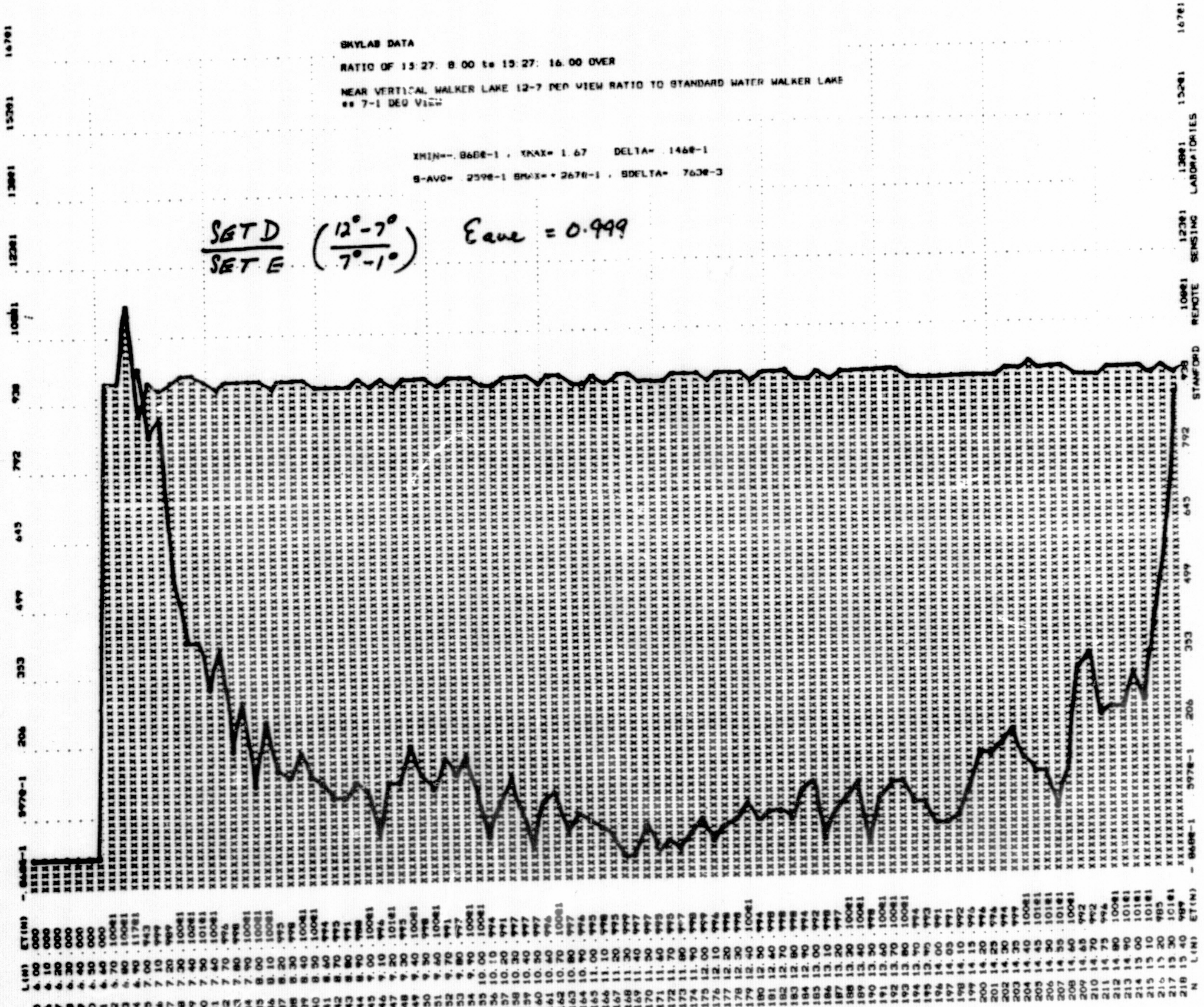

Figure 4.2.1.3.3 Ratio Set D/E

short of 7.60 μm, rather than in the reststrahlen region, from 8 to 11 μm, which had characterized the "water" spectra of Sets A and B.

When ratioed to "standard water" (Set E) (fig. 4.2.1.2.2) the emittance spectrum showed slightly less atmospheric band absorption (bands a, b, and e).

4.2.1.3 Near vertical water spectra. Two sets were selected, Set D of nine spectra from 15:27:02 to 15:27:10 correspond to view angles of 12° to 6° forward (fig. 4.2.1.3.1). Air masses of M = 1.02 to M = 1.01. Standard deviations were again low (S avg = 0.535 @ -5). The set selected as the "standard water" group (Set E) contain eight spectra (fig. 4.2.1.3.2) from 15:27:08 to 15:27:16, slightly overlapping Set D, with view angles of 7° to 1° forward, and air masses of M = 1.01 to M = 1.00. Almost similar standard deviations to Set D are noted (S avg = 0.533 @ -5) and both radiance and standard deviation plots are similar. "Emittance" (Set D/Set E) was calculated and the values are equal to unity except only in the atmospheric bands (fig. 4.2.1.3.3).

4.2.1.4 Angular differences in water spectra. Figure 4.2.1.4 compares tracings of the Set B/Set E; Set C/Set E emittance spectra, with Set A/Set E (the "contaminated" set) adjusted to emittance = 1.0 at about 8.5 μm. The decrease in strength of the absorption from the air can be seen in the lowered band depths for bands a, b, and e (6.90; 7.4; 9.70 (ozone) and a broad band at 13.4 to 1.41 μm). A weaker band (d) appears in the longer air paths (Sets A and B), as a doublet centered near 12.9 μm. (Band depths measured from central deepest point to a tangent connecting the band shoulders. See Bellamy, 1954; Lyon, 1958.) See table 4.2.1.4.

4.3 Discussion of Spectra and Terrain

4.3.1 RB57 Pallet Spectra: Rock and Soil Type Emissivities

Even a preliminary glance at the target spectra of figures 3.1.3 A to D shows significant differences in the important areas from 8.0 to 10.0 μm, which are doubly interesting when the spectral differences are related with the geological map, and with the photographs which show how the alluvials washed into their present locations (Qal) from the surrounding hilly outcrops. In a few cases one can postulate the drainage direction

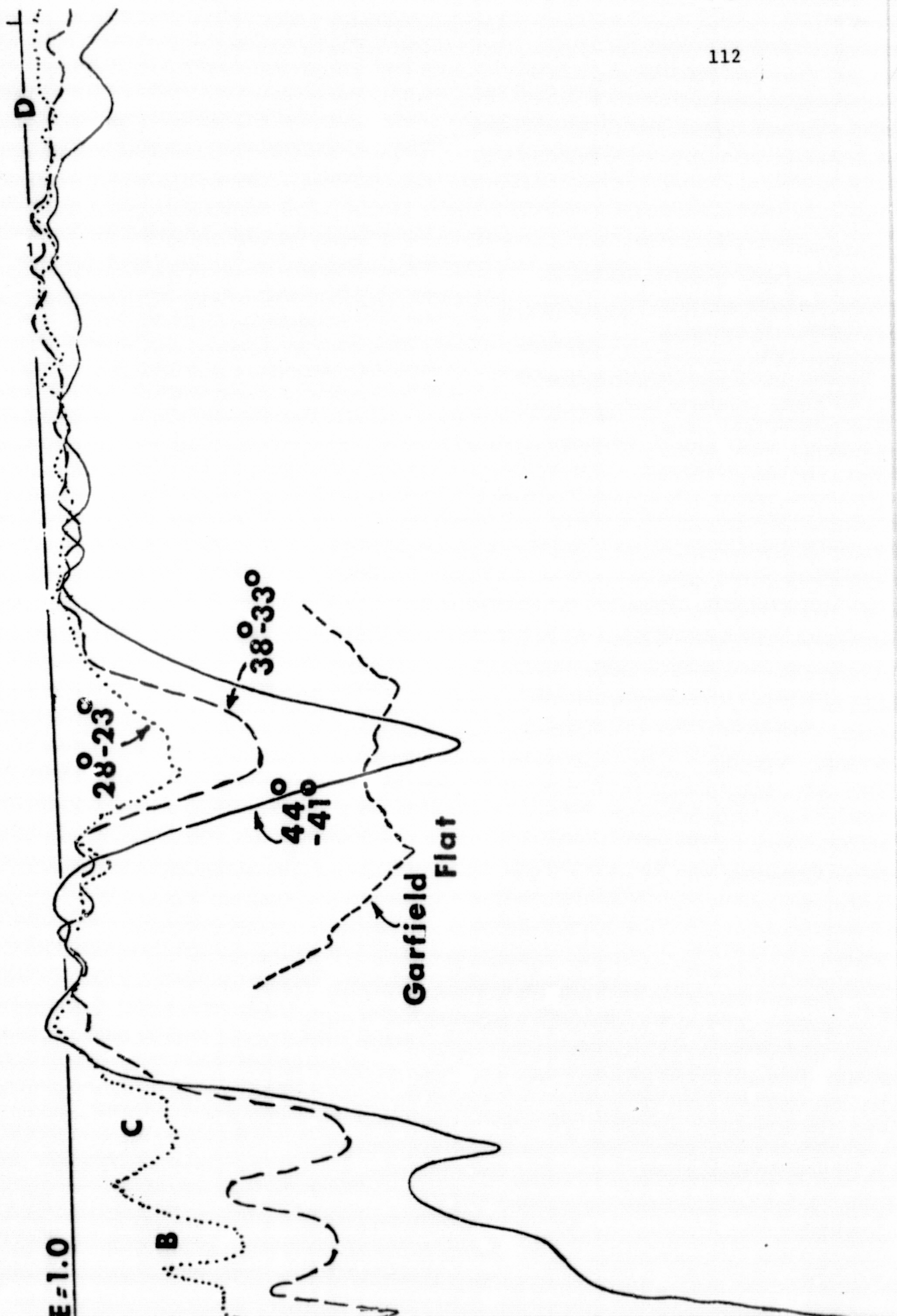

Figure 4.2.1.4 Comparison of band adsorptions with view angles

Table 4.2.1.4

Atmospheric Band Absorptions as Function of Air Mass

Band center (μm)	a 6.9	b 7.4	c 7.9	o** 9.6	d 12.6	e 13.7
Set A/Set E (44–41°) M = 1.37 avg	v. deep shoulders only		-80	-173	-15	-100
Set B/Set E (38–33°) M = 1.24 avg	deep	-30	-60	-75	-5	-52
Set C/Set E (28–23°) M = 1.11 avg	-140	-32	-30	-46	0	-28
Set D*/Set E (12–6°) M = 1.01 avg	+100*	+5*	0	+5*	0	0

*Radiance of Set > Set E so bands appear as slight peaks.

**o = ozone.

(provenance) for the alluvials from their spectral differences alone (see Qal, sites 7, 9, and 12).

4.3.1.1 Association of spectra with gross mineralogy. The 15 spectra in the four key figures (figs. 4.3.1.1.1 to 4.3.1.1.4) have been segregated so as to emphasize their similarities and their differences, while relating this to the gross mineralogy of the targets. On each figure the least diagnostic spectrum (Qtm, mafic volcanics) has been included as a dashed line to serve as a reference.

4.3.1.1.1 Granitic rocks. In fig. 4.3.1.1.1 the spectra taken over granitic terrain have been compared. Firstly the two intersections of the Wassuk Range granite (Kgr; Kgr-1, site 88 at 15:29:6 and Kgr-2, site 8a, at 16:13:11 GMT) show very similar spectra, considerably depressed in the quartz-region (near 9 µm). What is particularly interesting is that the Qal spectrum (Site 9) taken 13 km to the south near the town of Hawthorne, on an old higher level beach line for Walker Lake, shows almost identical

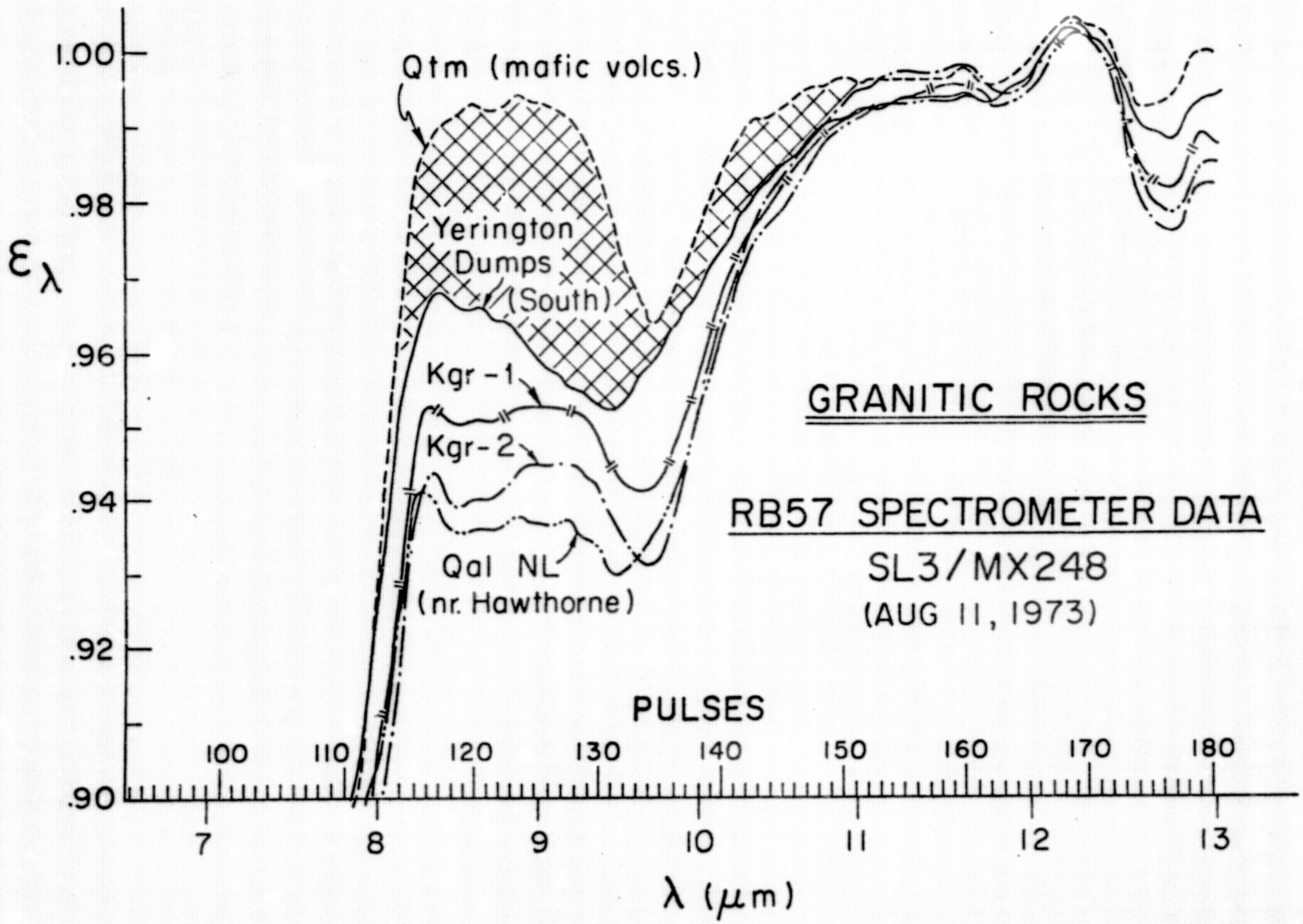

Figure 4.3.1.1.1 Target spectral emissivities (RB57)--granitic rocks

spectra indicative of a granitic soil composition. The fact that along most of the western shore of the lake the Wassuk Range is composed of granite (Kgr) and prevailing winds (from the NW) would have swept the sands around to site 9 without any hindrance. What is also striking is that the spoil dumps of waste rock (south dumps of the Yerington copper pit--site 1) are somewhat similar, but from their spectra one would infer they contained less quartz but are still feldspar rich. (The south dumps are principally composed of granodiorite and alluvium outwash from the felsic volcanics of the Singatse Range to the west of the copper pit, which would match this analysis.)

4.3.1.1.2 Mafic volcanics and metavolcanics. In figure 4.3.112 the mafic volcanics have been segregated along with some metavolcanics. A spectrum of Kgr-1 is included for contrast. The curves are much higher in the quartz area (quartz deficient) but show very little else of significance. This is typical of most emission spectra of basalts (Lyon, 1972, fig. 2). One would rank sites 6, 10, and 11 as mineralogically similar, and to resemble basalts.

4.3.1.1.3 Alluvium and sediments. In figure 4.3.113 several recent alluviums (Qal-1, -2, -3) from sites 2, 3, and 4 near Yerington (southeast of town) are compared with one from site 12 just short of Garfield Flat. Another mapped unit, Ts, a series of sediments has a very similar spectrum to Qal-1, -2, and -3, indicative of a more quartz-feldspathic source than the mafic volcanics of figure 4.3.112, but the metavolcanics of site 6 could easily be their source provenance, both mineralogically as well as geographically.

4.3.1.1.4 Playas and alluvium. A series of playa spectra (Garfield Flat and Gabbs playa) are compared with a sedimentary sequence (Luning Formation, of shales, limes and dolomites) and site 7 alluvium in figure 4.3.114. The Gabbs playa and site 7 Qal are similar except for the depth of the 9.6 ozone absorption. The carbonates (limes and dolomites) of the Luning Formation should not show reststrahlen features at these wavelengths and only the shale members (clays resembling playa clays) do so. Their spectra are simple, and those of Garfield Flat playa closely resemble the playa sediments of Lavic Lake in southern California overflow previously in Mission 108 (see Lyon, 1972, fig. 2E).

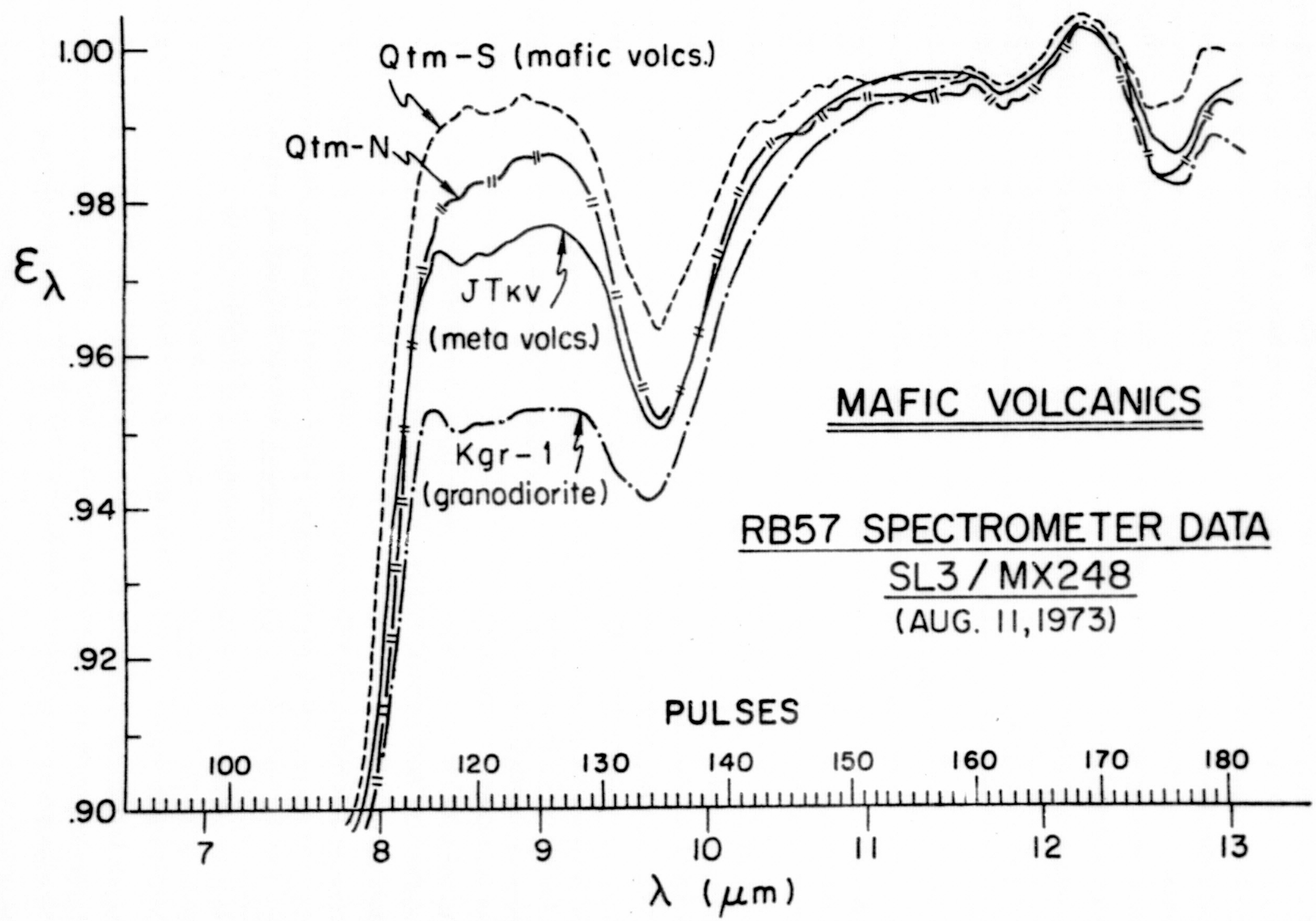

Figure 4.3.1.1.2 Target spectral emissivities (RB57)--mafic volcanics

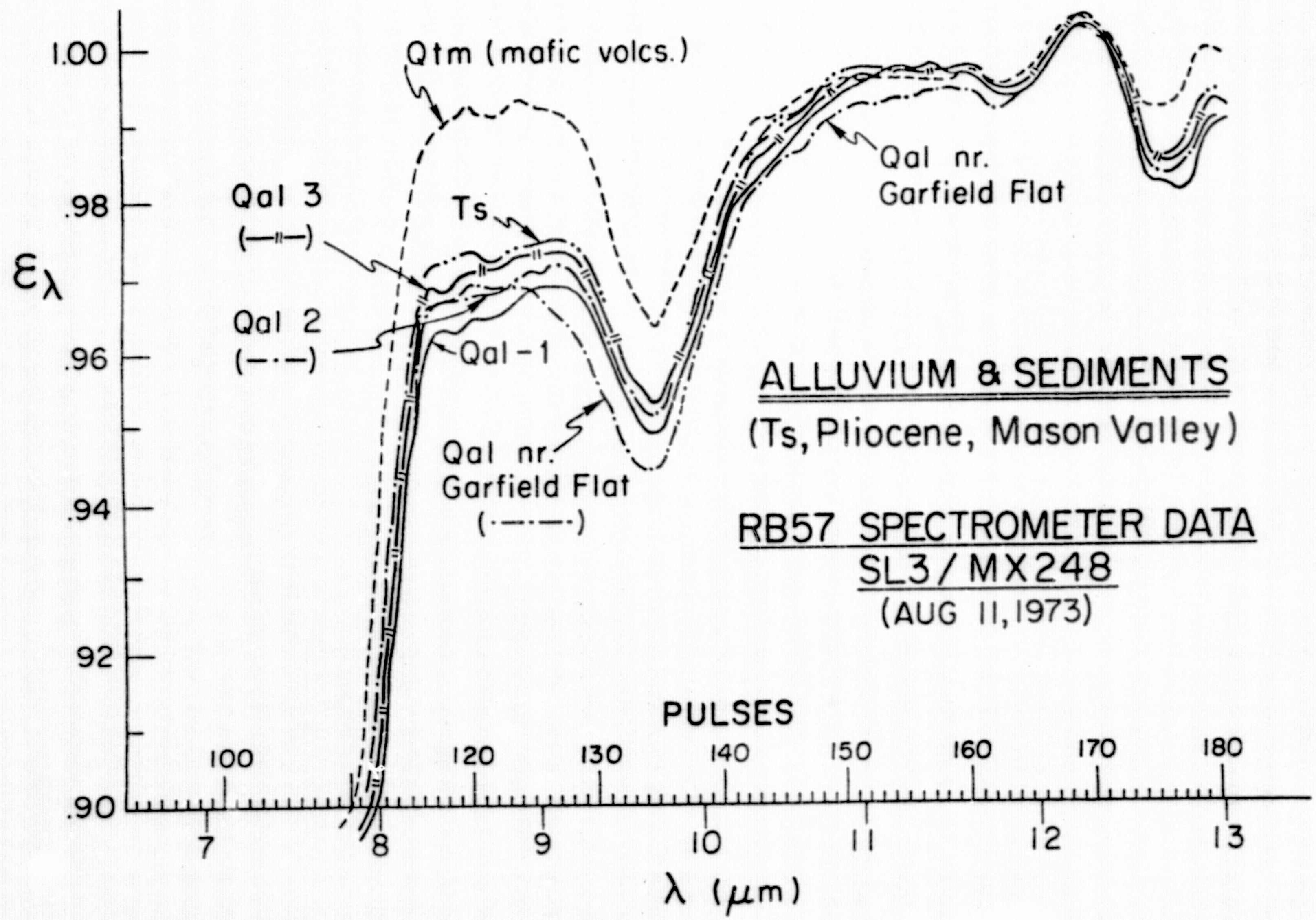

Figure 4.3.1.1.3 Target spectral emissivities (RB57)--alluvium and sediments

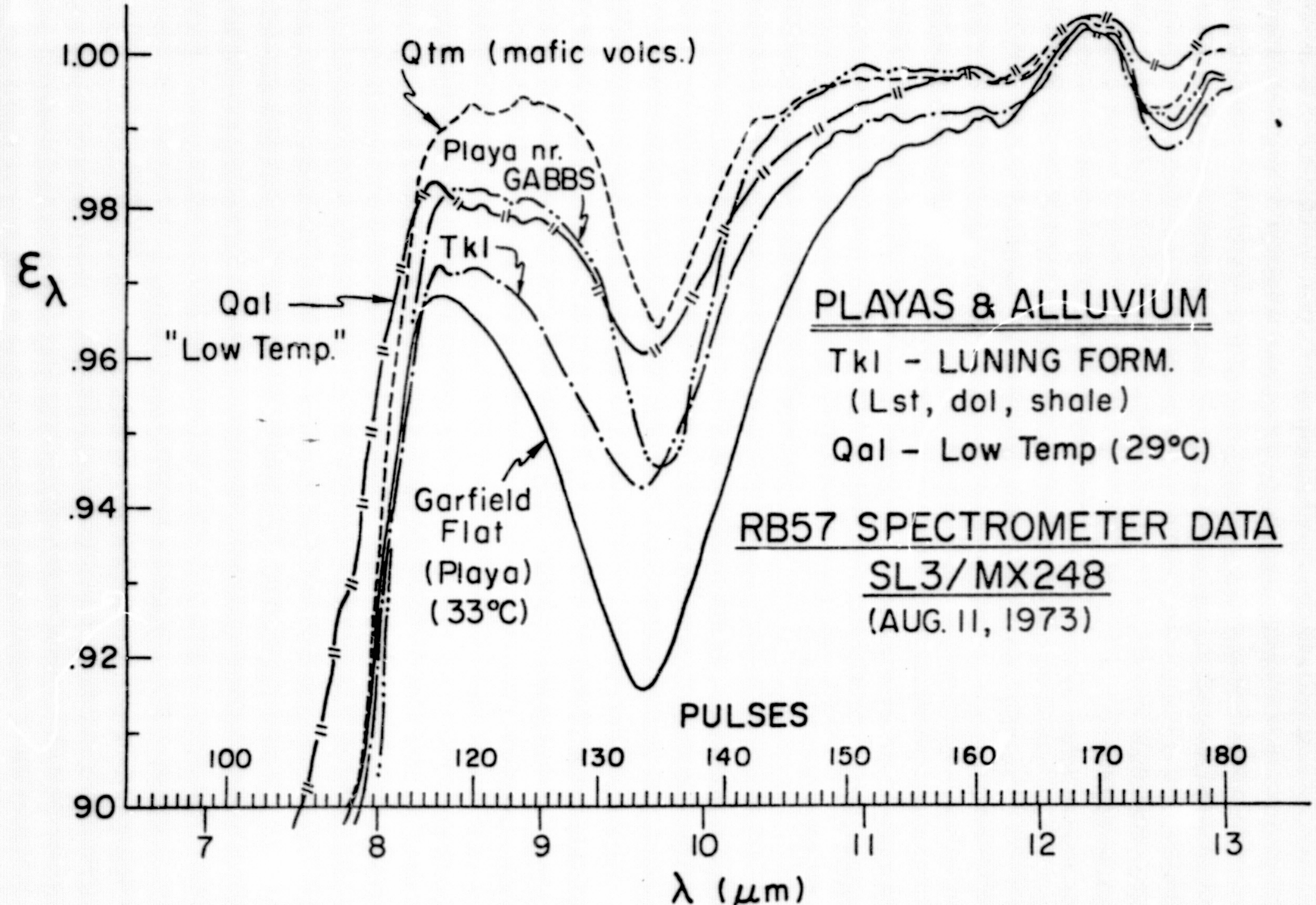

Figure 4.3.1.1.4 Target spectral emissivities (RB57)--playas and alluvium

4.3.2 RB57 Pallet Spectra: Geographic Variability

It is additionally instructive to examine the pallet spectra in a geographic sense relating the alluvial outwash soils to some of the exposures of rocks in the surrounding hills. For this purpose one needs to study figures 4.3.2 B, C, and D along with the geological strip map of the RB57 flight line (fig. 2.2).

Figure 4.3.2 A shows the locations of sites 1 through 5, plus their spectra. In these four figures (A-D) the spectral insets are at the same scale, the central cross line being at 9 μm wavelength, the left border at 8 μm, and the right at 10 μm. The base line is at 0.94 emittance, the cross line (horizontal) at 0.96 and the top at 1.00. All spectra are traced and scaled directly from figures 4.3.112-4.3.114 and are exactly correlable. The grid serves to emphasize the relative shapes and strength of the reststrahlen features. All three alluvium Qal-1, -2, and -3 are similar coming from closely adjacent patches of the flight line without crossing any mapped geological boundary. The sediment Ts is also similar and geographically close in a slightly closed basin. A spectrum of site 7 alluvium is included to show its spectral differences. The rocks of the Yerington dumps are also clearly different spectrally from either group, but show a shape similar to the site 7 alluvium.

Figure 4.3.2 B shows the site 7 alluvium and the closely adjacent metavolcanics of site 6 which they do not resemble spectrally. Neither does site 7 resemble the granites of sites 8a and 8b further south on the ridge of the Wassuk Range. However a rock type for which we were not able to obtain spectra, the Excelsior Formation (Tke) of intermediate to felsic volcanics outcrops immediately to the east up the ridge over a strike length of 15 km enclosing the Qal area on all uphill sides. This may have a sufficiently different spectrum so as to produce the Qal spectrum of site 7, particularly if it resembles the mafic volcanics spectrum of sites 10 and 11.

Figure 4.3.2 C shows the two granite (Kgr-1 and -2) and the Qal alluvium probably derived from their weathering, and transport south along the shores of Walker Lake. These spectra have been described in section 4.3.1.1.1, above.

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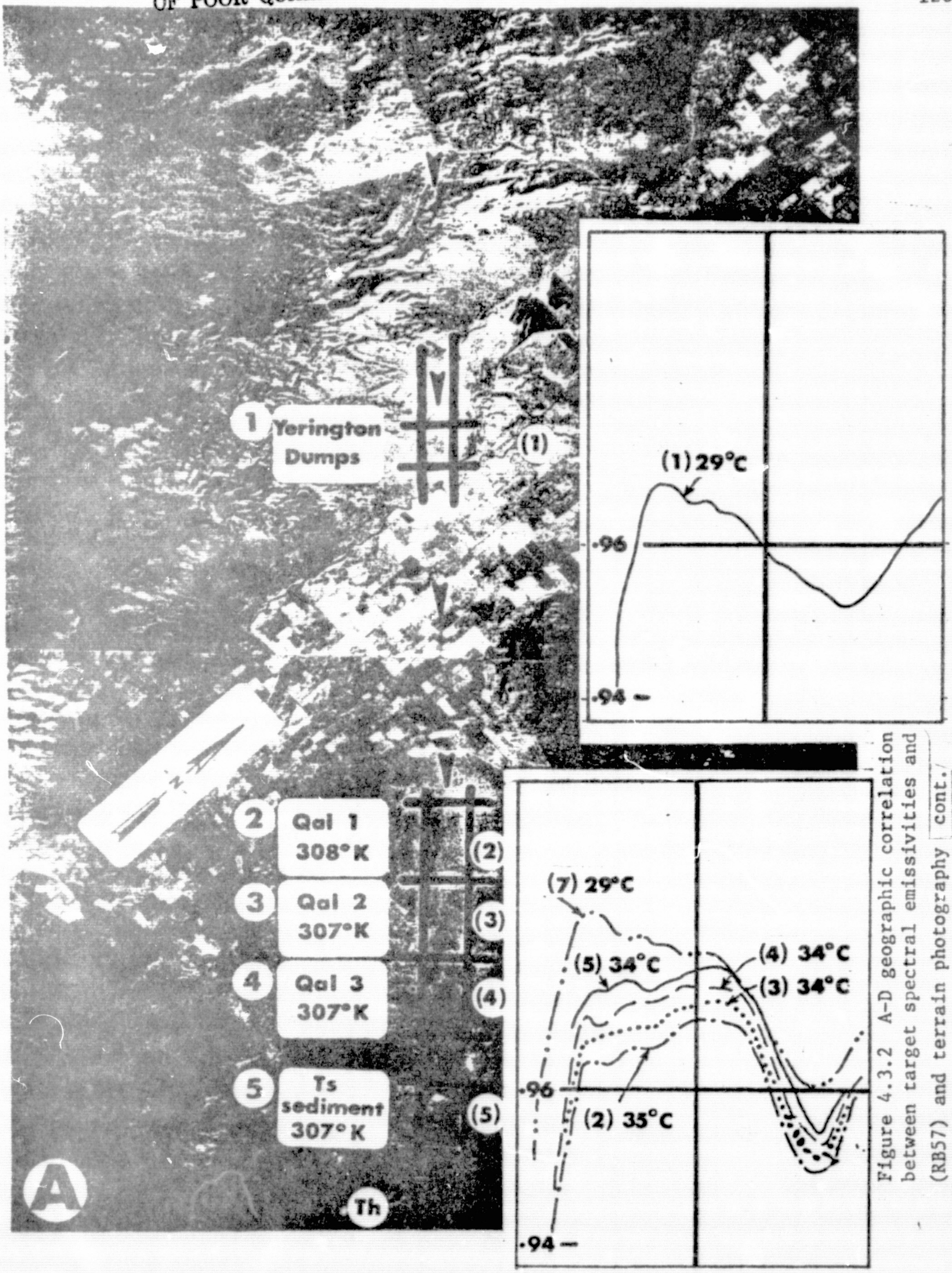
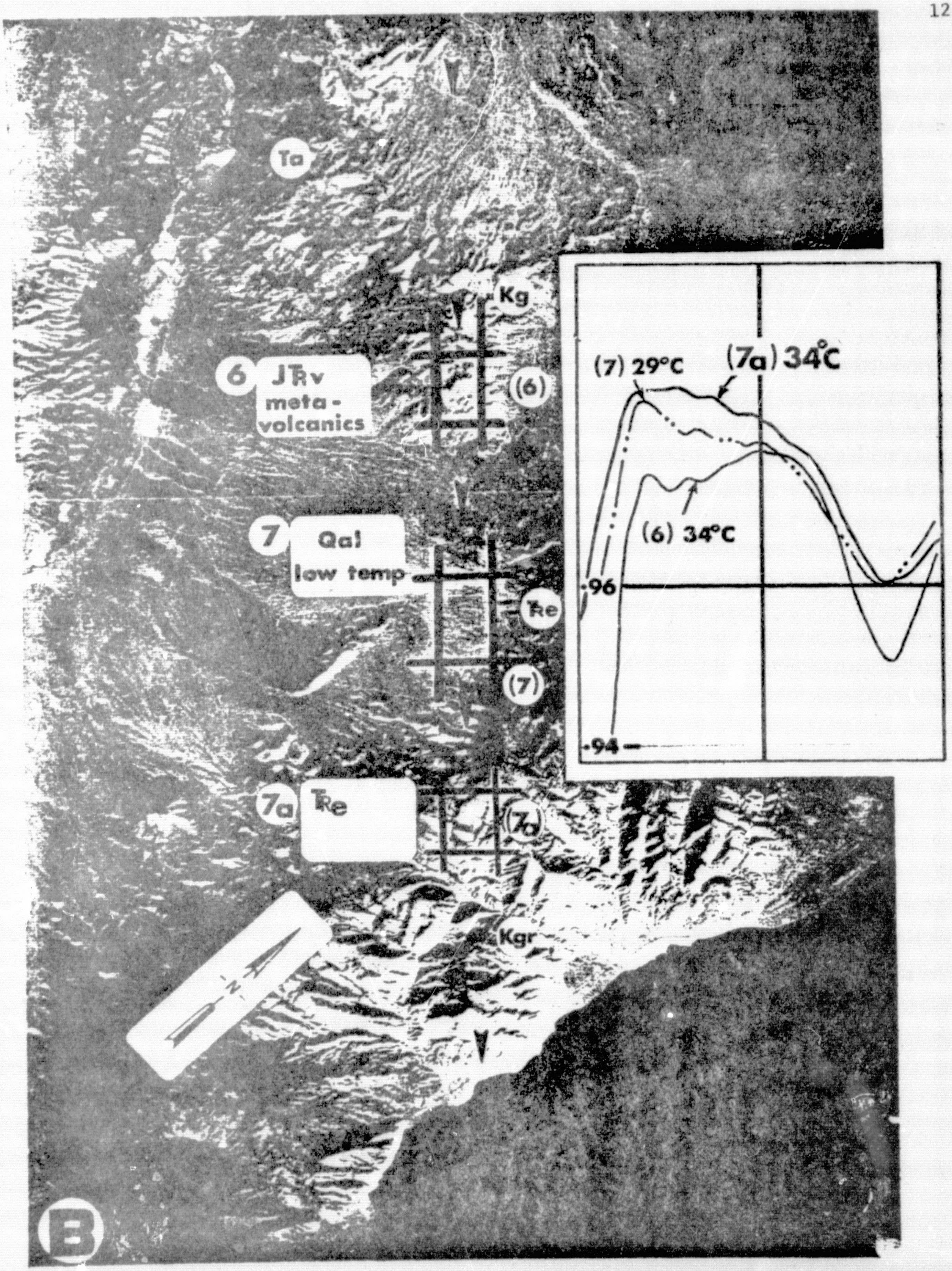
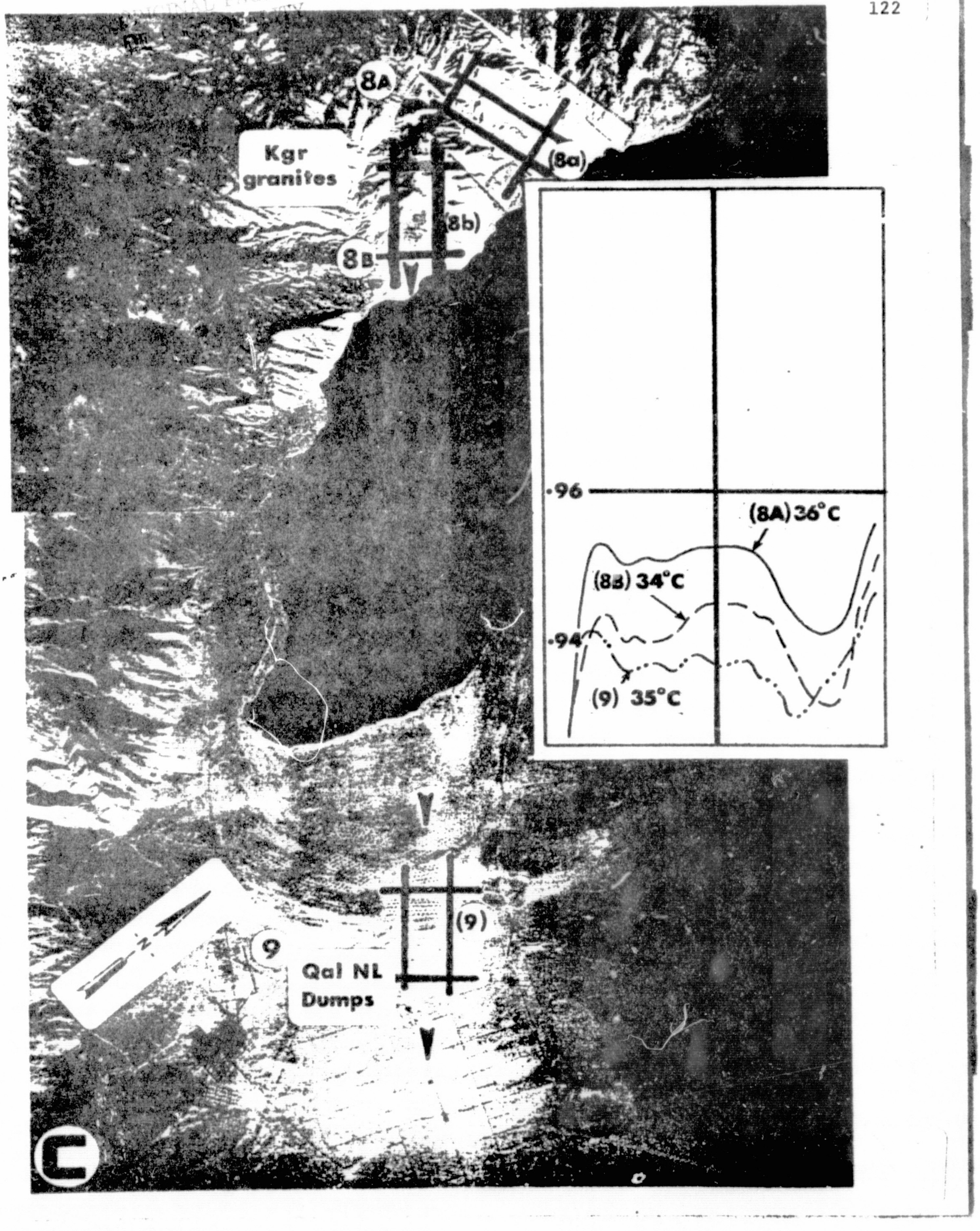


Figure 4.3.2 A-D geographic correlation between target spectral emissivities and (RB57) and terrain photography cont.


Ta
Kg
6 JTRv meta-volcanics
(6)
7 Qal low temp
TRe
(7)
7a TRe
(7a)
Kgr
N
B
(7) 29°C
(7a) 34°C
(6) 34°C
-96
-94



8A
Kgr granites
(8a)
(8b)
8B
-96
(8A) 36°C
(8B) 34°C
-94
(9) 35°C
(9)
9
Qal NL Dumps
N
C

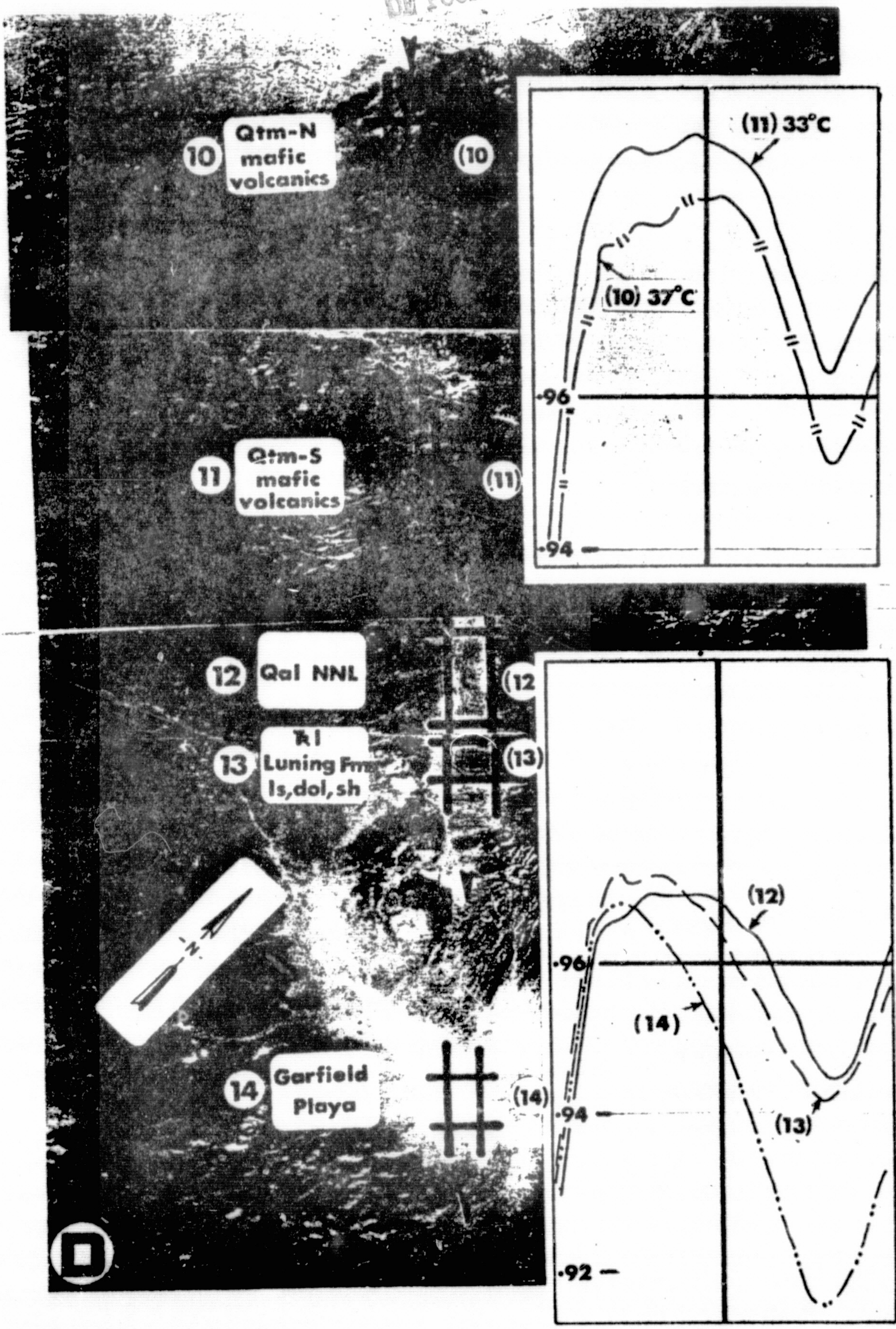

Qtm-N
mafic
volcanics
10
(10
(11) 33°C
(10) 37°C
96
94
Qtm-S
mafic
volcanics
11
(11)
12
Qal NNL
(12
13
Trl
Luning Fm
ls,dol,sh
(13)
N
14
Garfield
Playa
(14)
(12)
(14)
(13)
96
94
92
D

Figure 4.3.2 D shows in the northern portion two sites (10 and 11) from mafic volcanics which are broadly similar. Site 12, an outwash area to the south could receive sediment from either site 11, or site 13, where the Luning Formation occurs. The site 12 alluvium spectra more closely resemble site 11 of the mafic volcanics, which also ring site 12 in the eastern foothills and also spatially cover about 20 times the area of site 13 Luning Formation. This is another example of using spectra for a clue as to geologic sources for the alluvium.

Site 14, the Garfield Flat playa, does not resemble any other spectra, even that of the playa (site 15) near Gabbs far to the northeast, but is spectrally similar to other playas in southern California (Lavic Lake, see Lyon, 1972, fig. 2E).

4.3.3 SKYLAB S-191 Spectra: Garfield Flat

A set of 10 spectra was selected from those obtained while the S-191 spectrometer was pointing and holding over Garfield Flat playa. These (Set F) were from 15:27:29 to 15:27:34 and represent viewing angles of 3.5° to 8.5° backwards.

The radiance envelope (fig. 4.3.3.1) shows the expected high standard deviation in the silicate reststrahlen band (8 to 12 μm) with the typically low variation in the ozone band (0) itself. Average standard deviation (S avg) was 0.949 @ -5, about 50 percent higher than Walker Lake, and still lower than the Set A (contaminated) spectra.

The emittance spectrum (Set F/Set E) in figure 4.3.3.2 (labelled GF) is dramatically different from the Walker Lake set of emittance spectra (figs. 4.2.1.1.1 to 4.2.1.2.3), in the large emittance minimum (stippled), from 8.0 to around 12.4 μm, where the GF curve lies below the E = 1.00 line. This difference has a double maximum (at 9.20 and 10.0 μm) which is probably really a single (very wide) emittance low, with a minimum somewhere near the ozone peak at 9.7 μm, which in this spectrum is showing a local emittance maximum from ozone emission.

The key point though is shown by introducing one of the Walker Lake emittance spectra (M, mid view, Set C/Set E). Curve trace <u>M</u> uses the true emittance level E = 1.00; trace <u>M'</u> is raised so that the traces touch at X, 7.70 μm. Absorption <u>a</u>, <u>o</u>, and <u>e</u> only may be seen on the GF curve; b is a shoulder and c is confused as a part of the main minimum. (Figure 4.2.1.2.2)

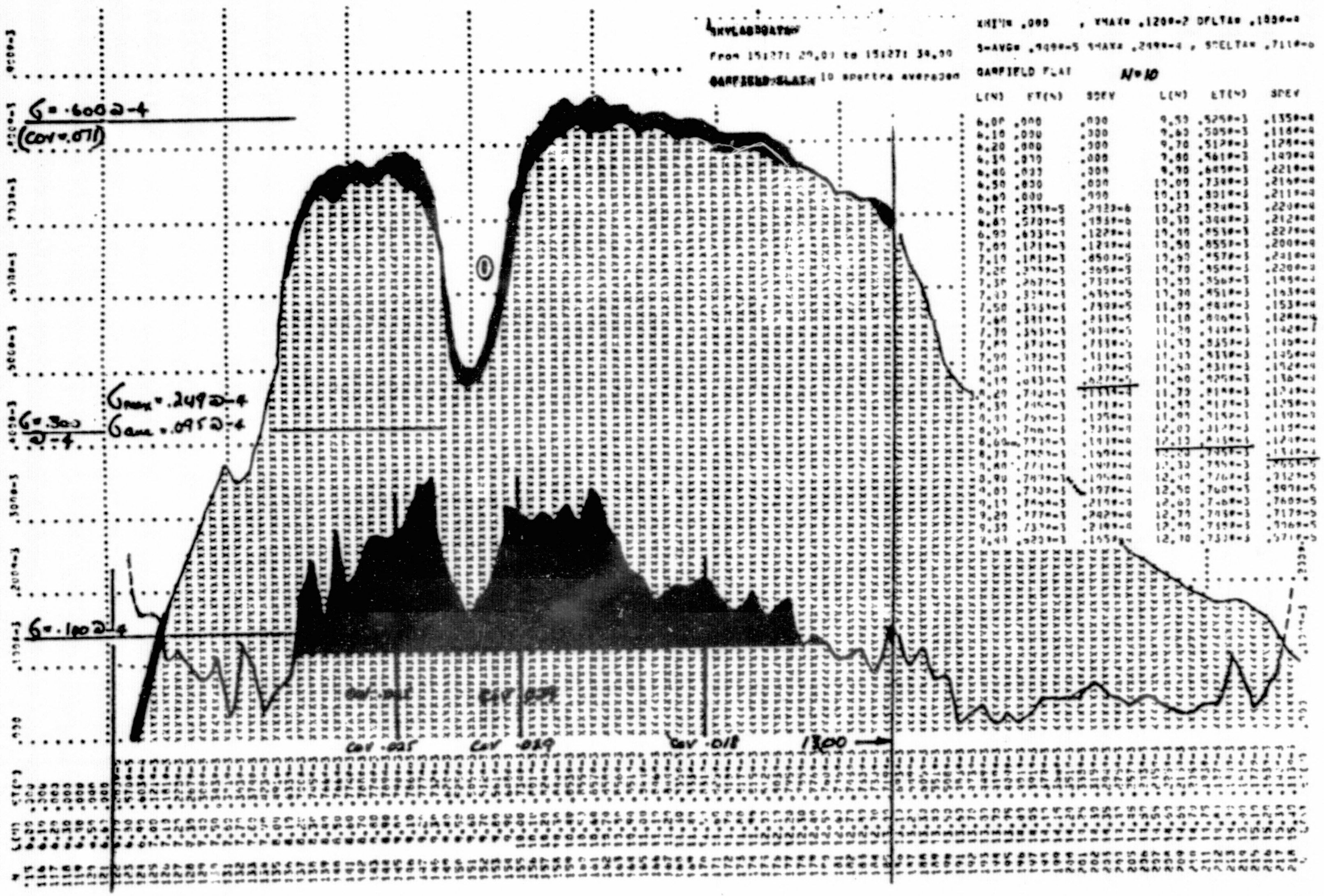


Figure 4.3.3.1 SKYLAB target emittance-
Garfield Flat

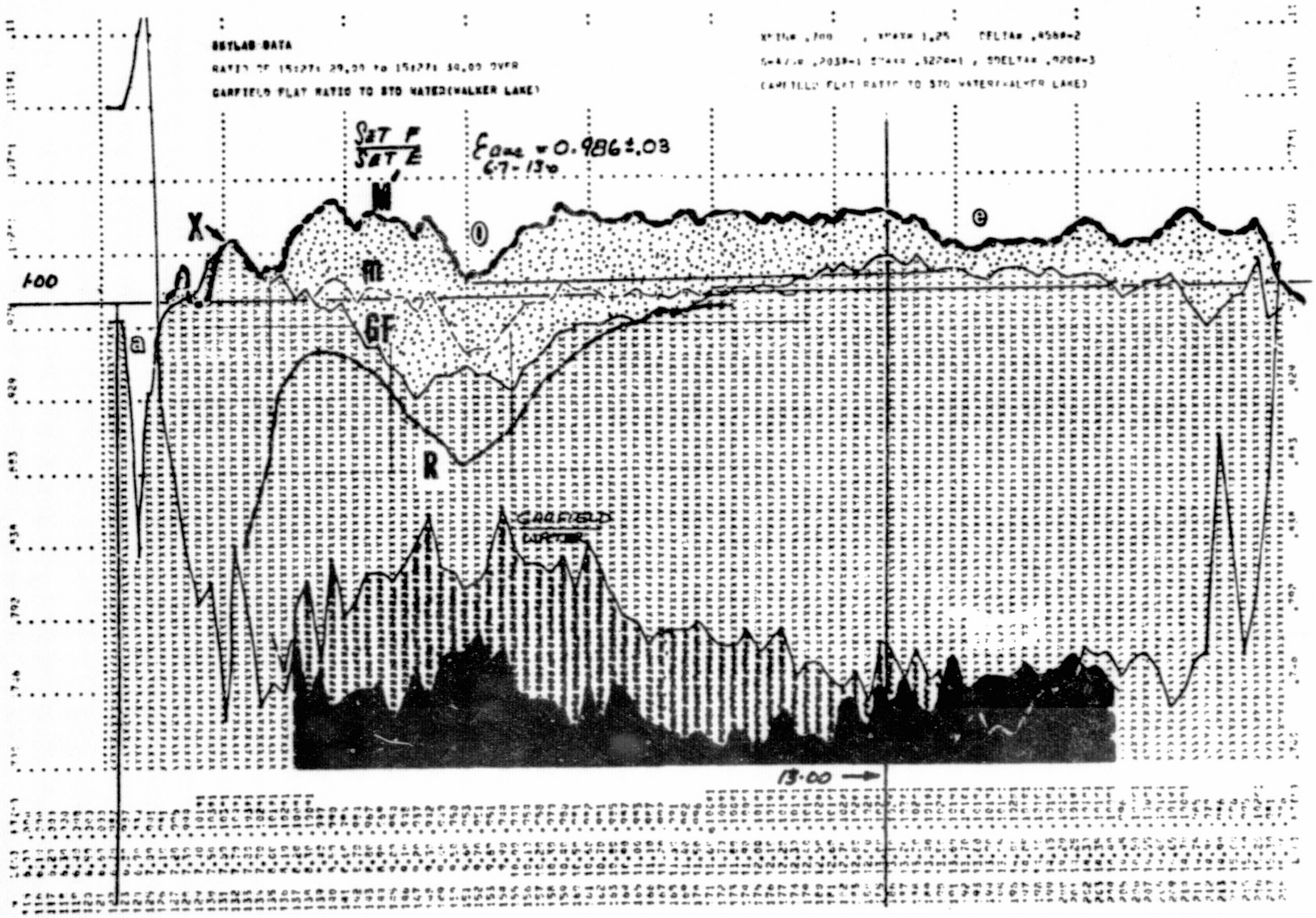


Figure 4.3.3.2 Target ratio to water--
Garfield Flat

126

SKYLAB DATA

From 15:27: 24.50 to 15.27 24.60

Y MTL X-MTL "A"

XMIN=-.180E-4 , XMAX= .100E-2 DELTA= .048E-5

S-AVG= .000 SMAX= .000 , SDELTA= .000

L(N)	ET(N)	SDEV	L(N)	ET(N)	SDEV	L(N)	ET(N)	SDEV
6.00	.000	.000	9.50	.557E-3	.000	13.00	.722E-3	.000
6.10	.000	.000	9.60	.537E-3	.000	13.10	.709E-3	.000
6.20	.000	.000	9.70	.547E-3	.000	13.20	.667E-3	.000
6.30	.000	.000	9.80	.600E-3	.000	13.30	.613E-3	.000
6.40	.000	.000	9.90	.702E-3	.000	13.40	.558E-3	.000
6.50	.000	.000	10.00	.771E-3	.000	13.50	.514E-3	.000
6.60	.000	.000	10.10	.856E-3	.000	13.60	.480E-3	.000
6.70	.430E-5	.000	10.20	.884E-3	.000	13.70	.474E-3	.000
6.80	.700E-5	.000	10.30	.894E-3	.000	13.80	.458E-3	.000
6.90	.780E-4	.000	10.40	.896E-3	.000	13.90	.425E-3	.000
7.00	.140E-3	.000	10.50	.901E-3	.000	13.95	.411E-3	.000
7.10	.167E-3	.000	10.60	.899E-3	.000	14.00	.402E-3	.000
7.20	.220E-3	.000	10.70	.890E-3	.000	14.05	.396E-3	.000
7.30	.256E-3	.000	10.80	.897E-3	.000	14.10	.385E-3	.000
7.40	.301E-3	.000	10.90	.891E-3	.000	14.15	.369E-3	.000
7.50	.337E-3	.000	11.00	.883E-3	.000	14.20	.353E-3	.000
7.60	.390E-3	.000	11.10	.879E-3	.000	14.25	.336E-3	.000
7.70	.363E-3	.000	11.20	.875E-3	.000	14.30	.311E-3	.000
7.80	.378E-3	.000	11.30	.862E-3	.000	14.35	.288E-3	.000
7.90	.430E-3	.000	11.40	.859E-3	.000	14.40	.272E-3	.000
8.00	.491E-3	.000	11.50	.860E-3	.000	14.45	.255E-3	.000
8.10	.632E-3	.000	11.60	.860E-3	.000	14.50	.241E-3	.000
8.20	.709E-3	.000	11.70	.853E-3	.000	14.55	.231E-3	.000
8.30	.733E-3	.000	11.80	.853E-3	.000	14.60	.223E-3	.000
8.40	.779E-3	.000	11.90	.854E-3	.000	14.65	.213E-3	.000
8.50	.819E-3	.000	12.00	.854E-3	.000	14.70	.203E-3	.000
8.60	.811E-3	.000	12.10	.847E-3	.000	14.75	.191E-3	.000
8.70	.849E-3	.000	12.20	.834E-3	.000	14.80	.183E-3	.000
8.80	.874E-3	.000	12.30	.827E-3	.000	14.90	.177E-3	.000
8.90	.877E-3	.000	12.40	.811E-3	.000	15.00	.170E-3	.000
9.00	.910E-3	.000	12.50	.780E-3	.000	15.10	.172E-3	.000
9.10	.916E-3	.000	12.60	.767E-3	.000	15.20	.154E-3	.000
9.20	.909E-3	.000	12.70	.757E-3	.000	15.30	.142E-3	.000
9.30	.779E-3	.000	12.80	.752E-3	.000	15.40	.107E-3	.000
9.40	.650E-3	.000	12.90	.740E-3	.000	.00	.000	.000

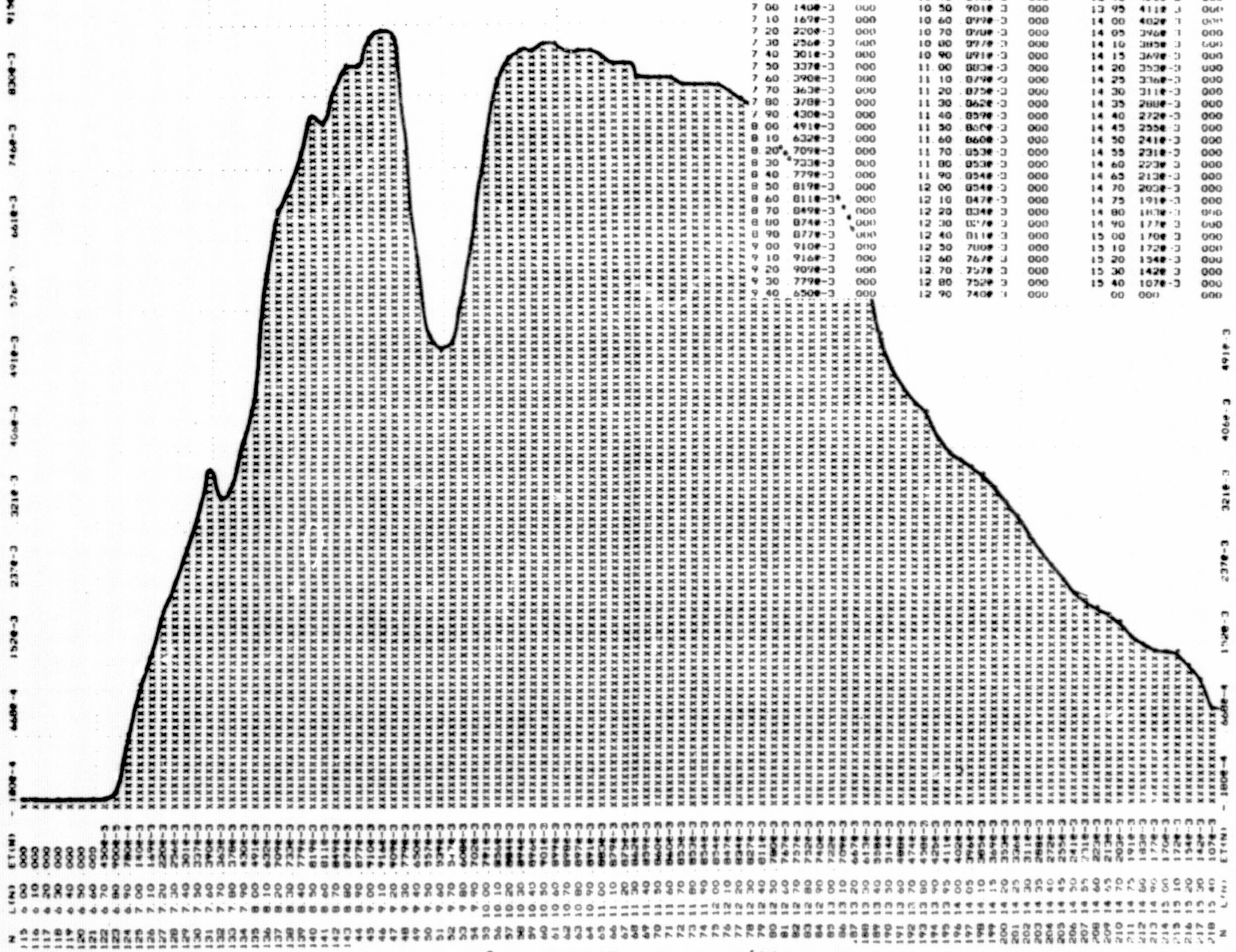


Figure 4.3.3.3 SKYLAB target emittance--
X-material A1, N = 1

SKYLAB DATA

X MTL   X-MTL "B"

From 15 27 25 40 to 15 27 25 50

1 spectra averaged

XMIN= .1000E-4 , XMAX= .1000E-2 DELTA= .8400E-5

S AVG= 000   SMAX= 000   , SDELTA= 000

L(N)	ET(N)	SDEV	L(N)	ET(N)	SDEV	L(N)	ET(N)	SDEV
6.00	000	.000	9.50	5420E-3	000	13.00	7560E-3	000
6.10	000	.000	9.60	5100E-3	000	13.10	7260E-3	000
6.20	000	000	9.70	5200E-3	000	13.20	6850E-3	000
6.30	000	000	9.80	5770E-3	000	13.30	6290E-3	000
6.40	000	000	9.90	6800E-3	000	13.40	5500E-3	000
6.50	000	000	10.00	7030E-3	000	13.50	5230E-3	000
6.60	000	000	10.10	8530E-3	000	13.60	4970E-3	000
6.70	4500E-5	000	10.20	8860E-3	000	13.70	4820E-3	000
6.80	9000E-5	.000	10.30	9030E-3	000	13.80	4650E-3	000
6.90	5500E-4	.000	10.40	9040E-3	000	13.90	4320E-3	000
7.00	1330E-3	000	10.50	9060E-3	000	13.95	4150E-3	000
7.10	1800E-3	000	10.60	9100E-3	000	14.00	4020E-3	000
7.20	2260E-3	000	10.70	9170E-3	000	14.05	3910E-3	000
7.30	2540E-3	000	10.80	9110E-3	000	14.10	3800E-3	000
7.40	2900E-3	000	10.90	9010E-3	000	14.15	3660E-3	000
7.50	3490E-3	.000	11.00	8930E-3	000	14.20	3520E-3	000
7.60	3770E-3	.000	11.10	8910E-3	000	14.25	3430E-3	000
7.70	3790E-3	.000	11.20	8930E-3	000	14.30	3220E-3	000
7.80	3770E-3	.000	11.30	8820E-3	000	14.35	2990E-3	000
7.90	4300E-3	.000	11.40	8700E-3	000	14.40	2760E-3	000
8.00	4920E-3	.000	11.50	8710E-3	000	14.45	2550E-3	000
8.10	6310E-3	.000	11.60	8690E-3	000	14.50	2370E-3	000
8.20	7250E-3	.000	11.70	8600E-3	000	14.55	2290E-3	000
8.30	7700E-3	.000	11.80	8550E-3	000	14.60	2160E-3	000
8.40	8020E-3	.000	11.90	8540E-3	000	14.65	2050E-3	000
8.50	8100E-3	.000	12.00	8490E-3	000	14.70	1980E-3	000
8.60	8040E-3	.000	12.10	8440E-3	000	14.75	1910E-3	000
8.70	8220E-3	.000	12.20	8330E-3	000	14.80	1860E-3	000
8.80	8410E-3	.000	12.30	8310E-3	000	14.90	1820E-3	000
8.90	8400E-3	.000	12.40	8150E-3	000	15.00	1760E-3	000
9.00	8500E-3	.000	12.50	7960E-3	000	15.10	1740E-3	000
9.10	8440E-3	.000	12.60	7800E-3	000	15.20	1580E-3	000
9.20	8490E-3	000	12.70	7780E-3	000	15.30	1200E-3	000
9.30	7410E-3	000	12.80	7790E-3	000	15.40	1060E-3	000
9.40	6290E-3	.000	12.90	7730E-3	000	00	000	000

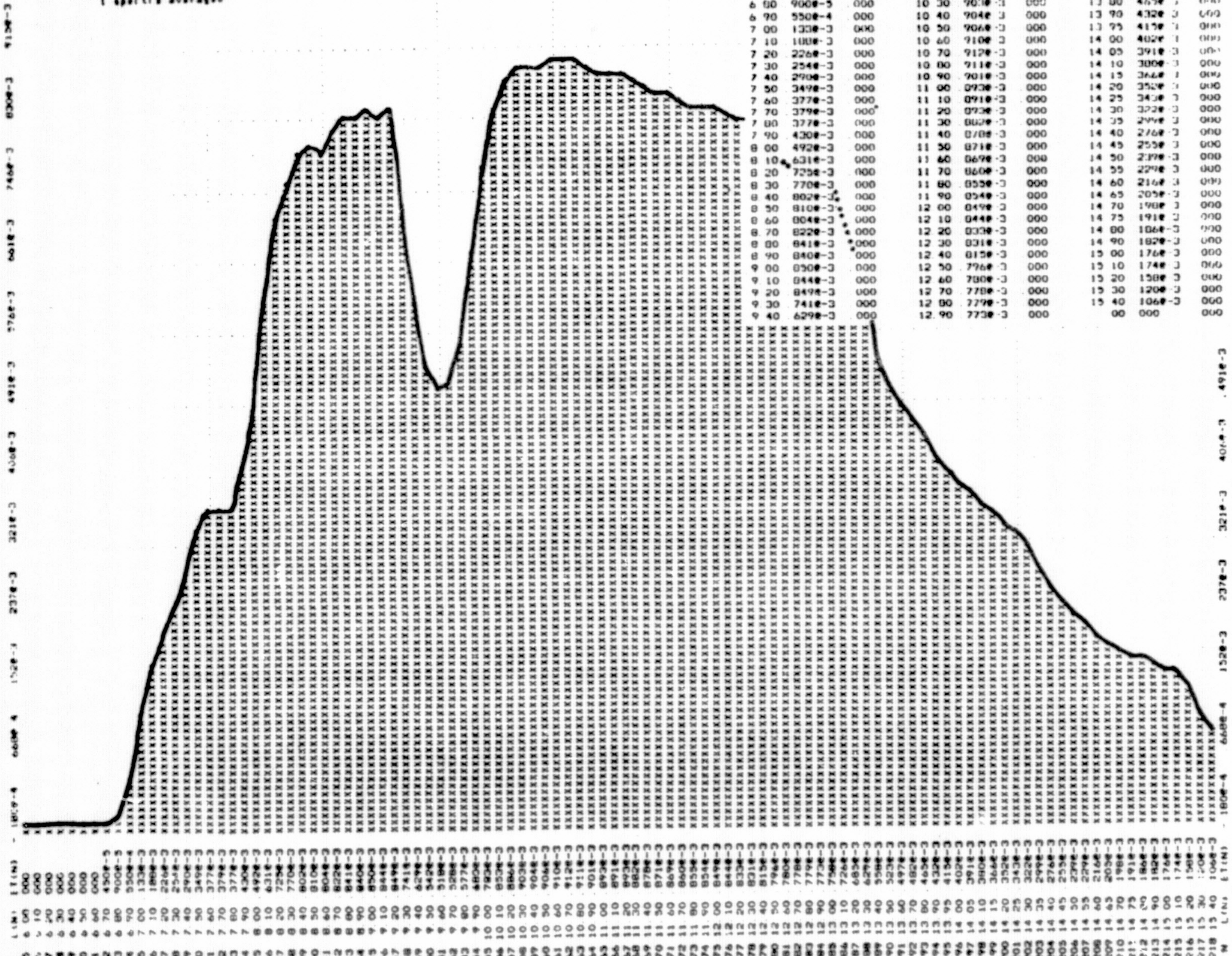


Figure 4.3.3.4 SKYLAB target emittance--
X-material B, N = 1

SKYLAB DATA

X MTL

From 15:27: 26.40 to 15:27: 26.50

1 spectra averaged

XMIN= -.180Ø-4 , XMAX= .100Ø-2 DELTA= .8489-5

S-AVG= .000 SMAX= .000 , SDELTA= .000

X MTL X-MTL "C"

L(N)	ET(N)	SDEV	L(N)	ET(N)	SDEV	L(N)	ET(N)	SDEV
6.00	.000	.000	9.50	.557Ø-3	.000	13.00	.746Ø-3	.000
6.10	.000	.000	9.60	.542Ø-3	.000	13.10	.723Ø-3	.000
6.20	.000	.000	9.70	.550Ø-3	.000	13.20	.681Ø-3	.000
6.30	.000	.000	9.80	.606Ø-3	.000	13.30	.624Ø-3	.000
6.40	.000	.000	9.90	.703Ø-3	.000	13.40	.556Ø-3	.000
6.50	.000	.000	10.00	.801Ø-3	.000	13.50	.519Ø-3	.000
6.60	.000	.000	10.10	.865Ø-3	.000	13.60	.494Ø-3	.000
6.70	.400Ø-5	.000	10.20	.894Ø-3	.000	13.70	.486Ø-3	.000
6.80	.800Ø-5	.000	10.30	.896Ø-3	.000	13.80	.461Ø-3	.000
6.90	.930Ø-4	.000	10.40	.918Ø-3	.000	13.90	.425Ø-3	.000
7.00	.135Ø-3	.000	10.50	.902Ø-3	.000	13.95	.412Ø-3	.000
7.10	.195Ø-3	.000	10.60	.900Ø-3	.000	14.00	.404Ø-3	.000
7.20	.220Ø-3	.000	10.70	.906Ø-3	.000	14.05	.396Ø-3	.000
7.30	.262Ø-3	.000	10.80	.910Ø-3	.000	14.10	.385Ø-3	.000
7.40	.304Ø-3	.000	10.90	.899Ø-3	.000	14.15	.371Ø-3	.000
7.50	.326Ø-3	.000	11.00	.889Ø-3	.000	14.20	.355Ø-3	.000
7.60	.373Ø-3	.000	11.10	.888Ø-3	.000	14.25	.341Ø-3	.000
7.70	.362Ø-3	.000	11.20	.870Ø-3	.000	14.30	.316Ø-3	.000
7.80	.362Ø-3	.000	11.30	.873Ø-3	.000	14.35	.298Ø-3	.000
7.90	.434Ø-3	.000	11.40	.866Ø-3	.000	14.40	.279Ø-3	.000
8.00	.492Ø-3	.000	11.50	.858Ø-3	.000	14.45	.262Ø-3	.000
8.10	.642Ø-3	.000	11.60	.856Ø-3	.000	14.50	.244Ø-3	.000
8.20	.729Ø-3	.000	11.70	.851Ø-3	.000	14.55	.233Ø-3	.000
8.30	.781Ø-3	.000	11.80	.844Ø-3	.000	14.60	.224Ø-3	.000
8.40	.812Ø-3	.000	11.90	.843Ø-3	.000	14.65	.213Ø-3	.000
8.50	.815Ø-3	.000	12.00	.842Ø-3	.000	14.70	.203Ø-3	.000
8.60	.829Ø-3	.000	12.10	.836Ø-3	.000	14.75	.194Ø-3	.000
8.70	.853Ø-3	.000	12.20	.833Ø-3	.000	14.80	.191Ø-3	.000
8.80	.849Ø-3	.000	12.30	.820Ø-3	.000	14.90	.182Ø-3	.000
8.90	.875Ø-3	.000	12.40	.807Ø-3	.000	15.00	.172Ø-3	.000
9.00	.882Ø-3	.000	12.50	.786Ø-3	.000	15.10	.173Ø-3	.000
9.10	.872Ø-3	.000	12.60	.767Ø-3	.000	15.20	.159Ø-3	.000
9.20	.867Ø-3	.000	12.70	.766Ø-3	.000	15.30	.135Ø-3	.000
9.30	.792Ø-3	.000	12.80	.760Ø-3	.000	15.40	.970Ø-4	.000
9.40	.653Ø-3	.000	12.90	.762Ø-3	.000	.00	.000	.000

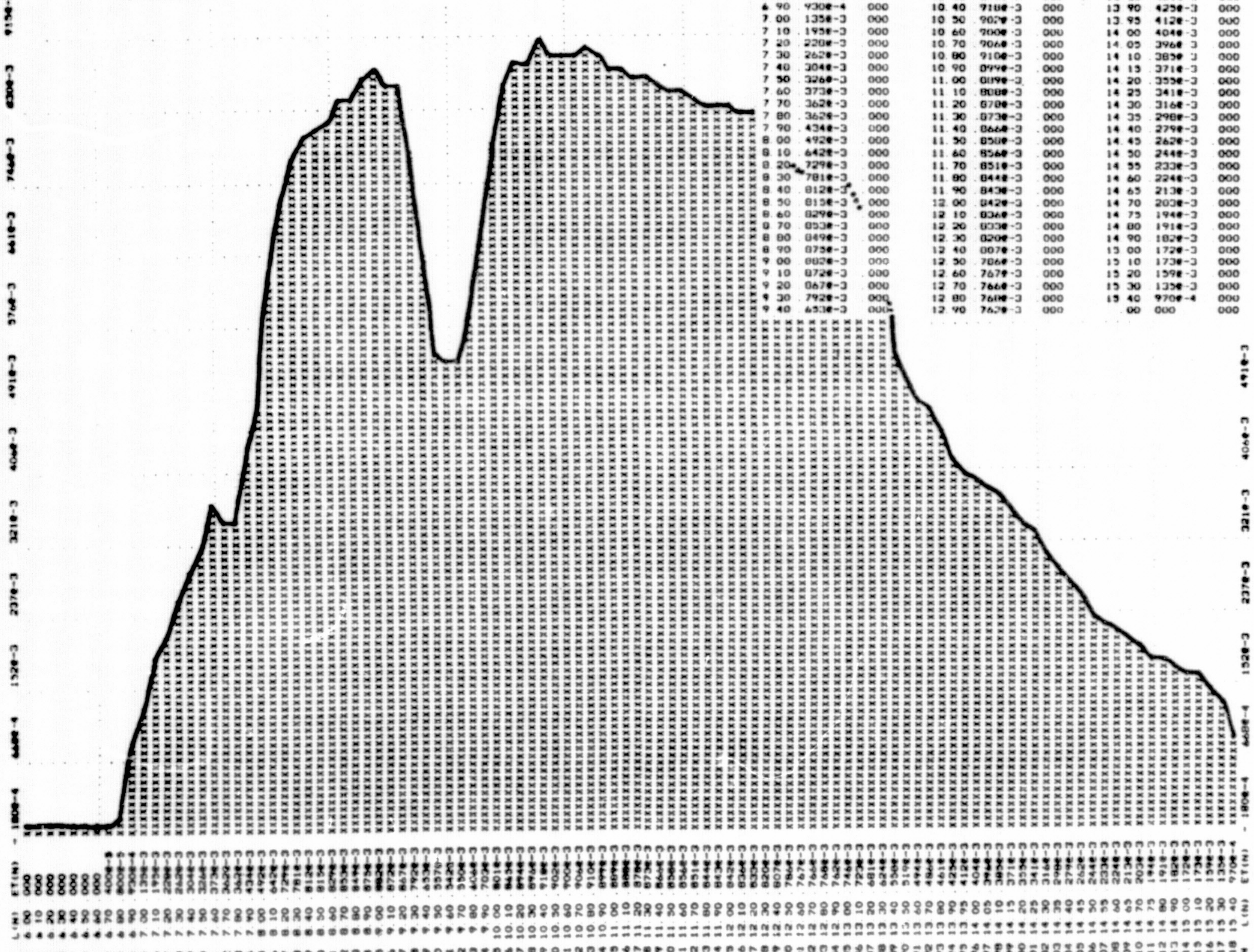


Figure 4.3.3.5 SKYLAB target emittance
X-material C, N = 1

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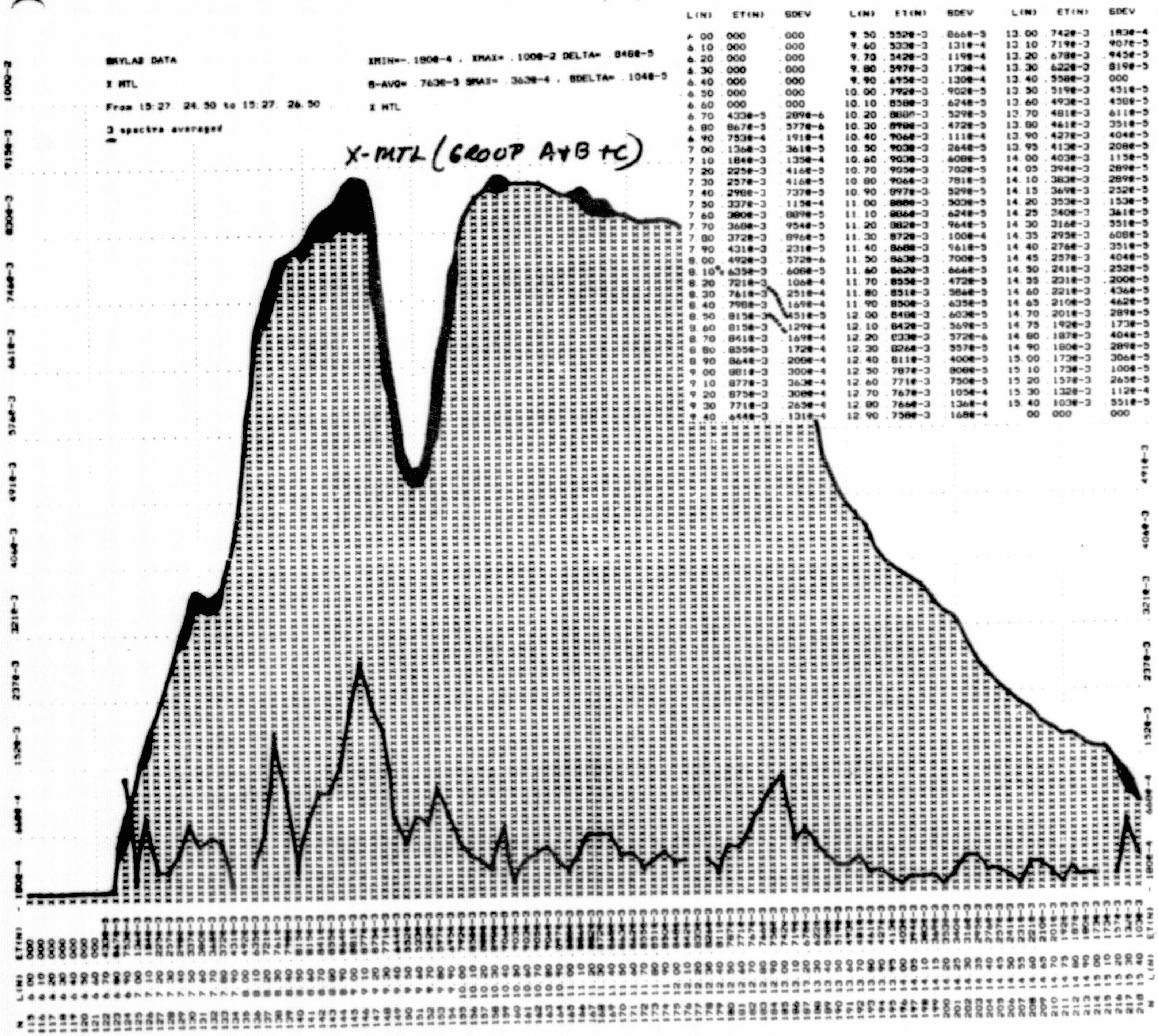


L(N)	ET(N)	SDEV	L(N)	ET(N)	SDEV	L(N)	ET(N)	SDEV
6.00	.000	.000	9.50	.552E-3	.866E-5	13.00	.742E-3	.183E-4
6.10	.000	.000	9.60	.533E-3	.131E-4	13.10	.719E-3	.907E-5
6.20	.000	.000	9.70	.542E-3	.119E-4	13.20	.678E-3	.945E-5
6.30	.000	.000	9.80	.597E-3	.173E-4	13.30	.622E-3	.819E-5
6.40	.000	.000	9.90	.695E-3	.130E-4	13.40	.558E-3	.000
6.50	.000	.000	10.00	.792E-3	.902E-5	13.50	.519E-3	.451E-5
6.60	.000	.000	10.10	.838E-3	.624E-5	13.60	.493E-3	.458E-5
6.70	.433E-5	.289E-6	10.20	.888E-3	.529E-5	13.70	.481E-3	.611E-5
6.80	.867E-5	.577E-6	10.30	.898E-3	.472E-5	13.80	.461E-3	.351E-5
6.90	.753E-4	.191E-4	10.40	.906E-3	.111E-4	13.90	.427E-3	.404E-5
7.00	.136E-3	.361E-5	10.50	.903E-3	.264E-5	13.95	.413E-3	.208E-5
7.10	.184E-3	.135E-4	10.60	.903E-3	.608E-5	14.00	.403E-3	.115E-5
7.20	.225E-3	.416E-5	10.70	.905E-3	.702E-5	14.05	.394E-3	.289E-5
7.30	.257E-3	.416E-5	10.80	.906E-3	.781E-5	14.10	.383E-3	.289E-5
7.40	.298E-3	.737E-5	10.90	.897E-3	.529E-5	14.15	.369E-3	.252E-5
7.50	.337E-3	.115E-4	11.00	.888E-3	.503E-5	14.20	.353E-3	.153E-5
7.60	.380E-3	.889E-5	11.10	.886E-3	.624E-5	14.25	.340E-3	.361E-5
7.70	.368E-3	.954E-5	11.20	.882E-3	.964E-5	14.30	.316E-3	.551E-5
7.80	.372E-3	.896E-5	11.30	.872E-3	.100E-4	14.35	.295E-3	.608E-5
7.90	.431E-3	.231E-5	11.40	.868E-3	.961E-5	14.40	.276E-3	.351E-5
8.00	.492E-3	.572E-6	11.50	.863E-3	.700E-5	14.45	.257E-3	.404E-5
8.10	.635E-3	.606E-5	11.60	.862E-3	.666E-5	14.50	.241E-3	.252E-5
8.20	.721E-3	.106E-4	11.70	.855E-3	.472E-5	14.55	.231E-3	.200E-5
8.30	.761E-3	.251E-4	11.80	.851E-3	.586E-5	14.60	.221E-3	.436E-5
8.40	.798E-3	.169E-4	11.90	.850E-3	.635E-5	14.65	.210E-3	.462E-5
8.50	.815E-3	.451E-5	12.00	.848E-3	.603E-5	14.70	.201E-3	.289E-5
8.60	.815E-3	.129E-4	12.10	.842E-3	.569E-5	14.75	.192E-3	.173E-5
8.70	.841E-3	.169E-4	12.20	.833E-3	.572E-6	14.80	.187E-3	.404E-5
8.80	.835E-3	.172E-4	12.30	.826E-3	.557E-5	14.90	.180E-3	.289E-5
8.90	.864E-3	.206E-4	12.40	.811E-3	.400E-5	15.00	.173E-3	.306E-5
9.00	.881E-3	.300E-4	12.50	.787E-3	.808E-5	15.10	.173E-3	.100E-5
9.10	.877E-3	.363E-4	12.60	.771E-3	.750E-5	15.20	.157E-3	.265E-5
9.20	.875E-3	.308E-4	12.70	.767E-3	.105E-4	15.30	.132E-3	.112E-4
9.30	.771E-3	.265E-4	12.80	.766E-3	.136E-4	15.40	.103E-3	.551E-5
9.40	.644E-3	.131E-4	12.90	.758E-3	.168E-4	00	000	000

Figure 4.3.3.6 SKYLAB target emittance--
(A + B + C), N = 3

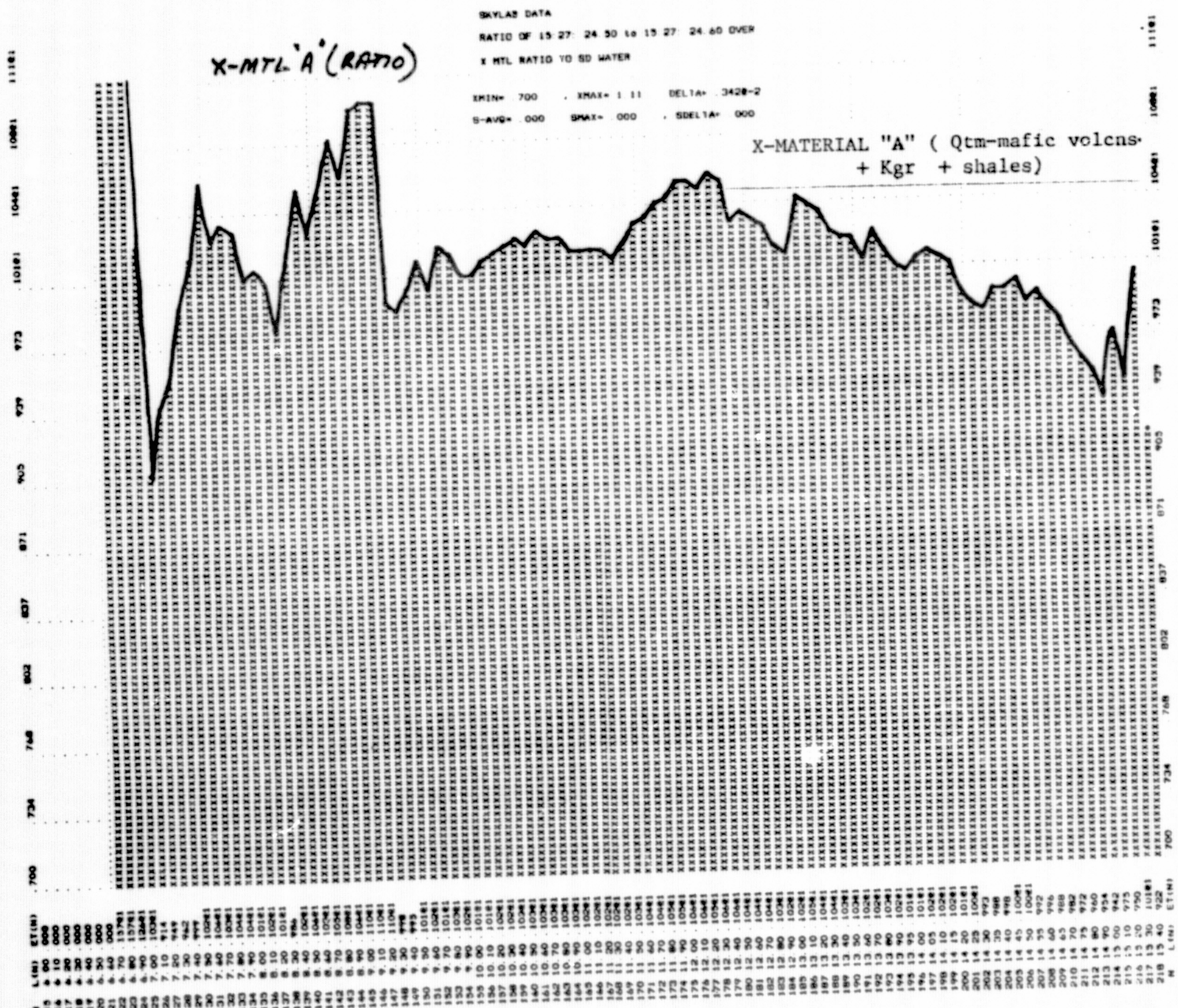


Figure 4.3.3.7 Target ratio to water-- X- material A

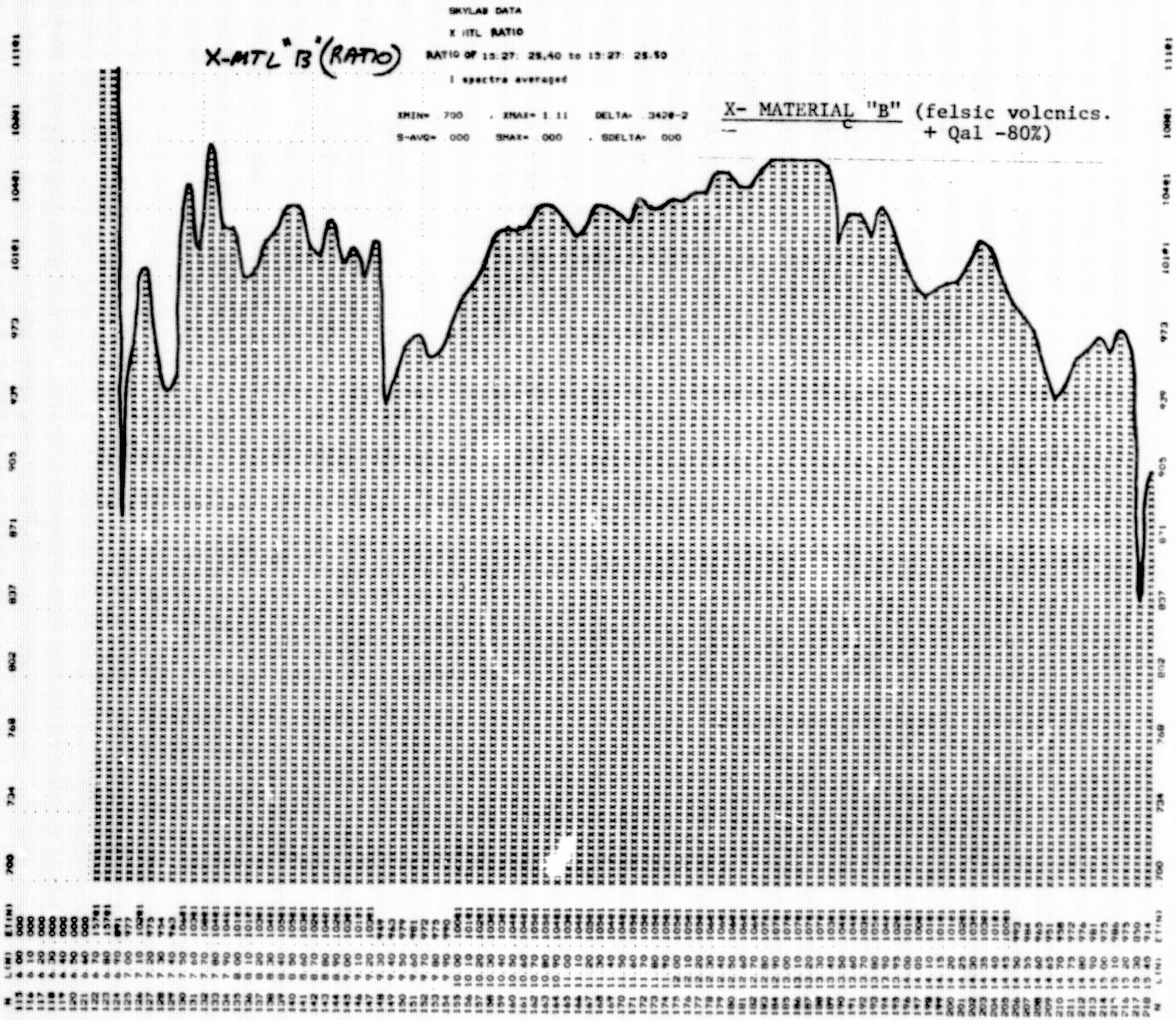


Figure 4.3.3.8 Target ratio to water--
X- material B

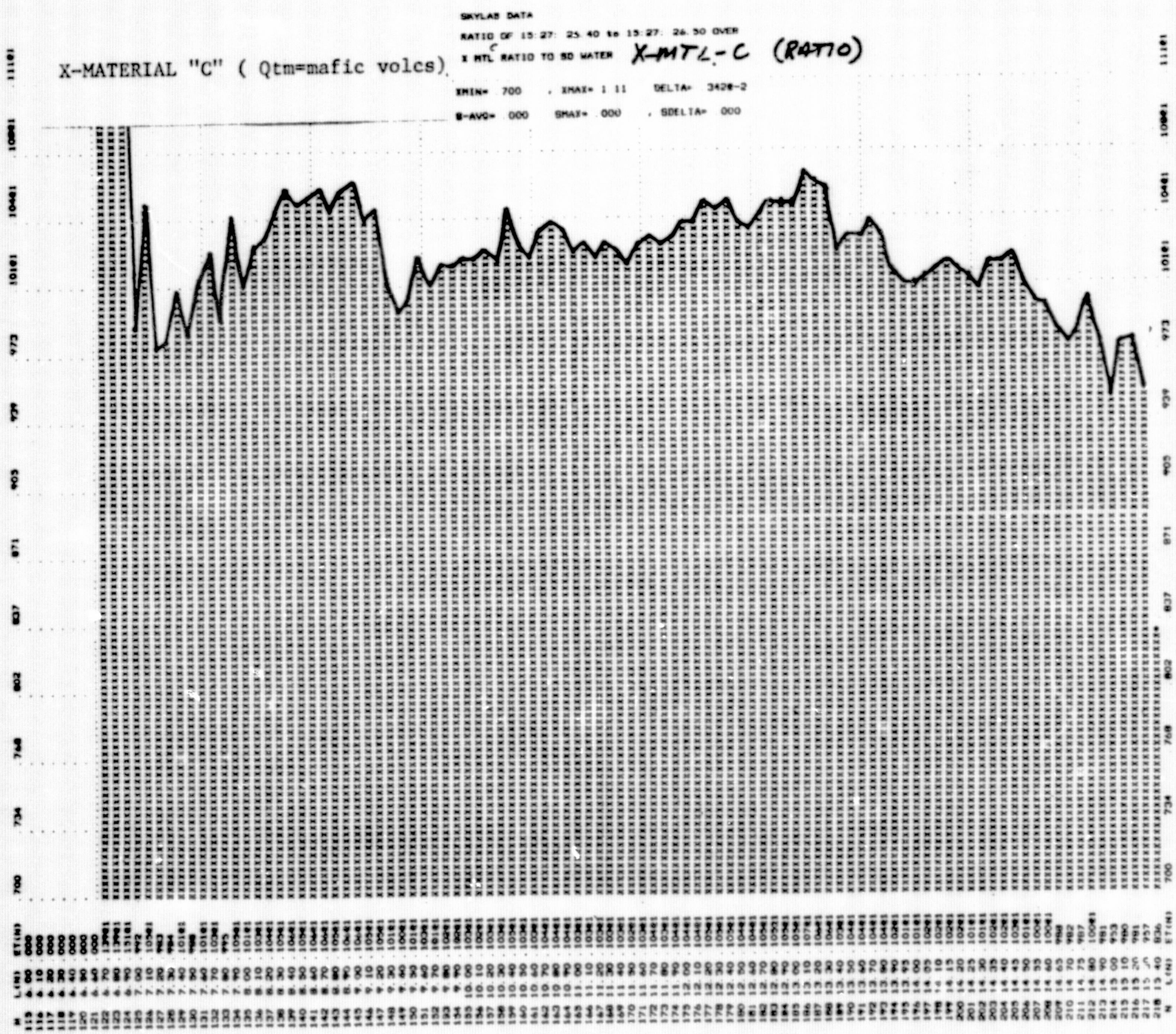


Figure 4.3.3.9 Target ratio to water--
X-material C

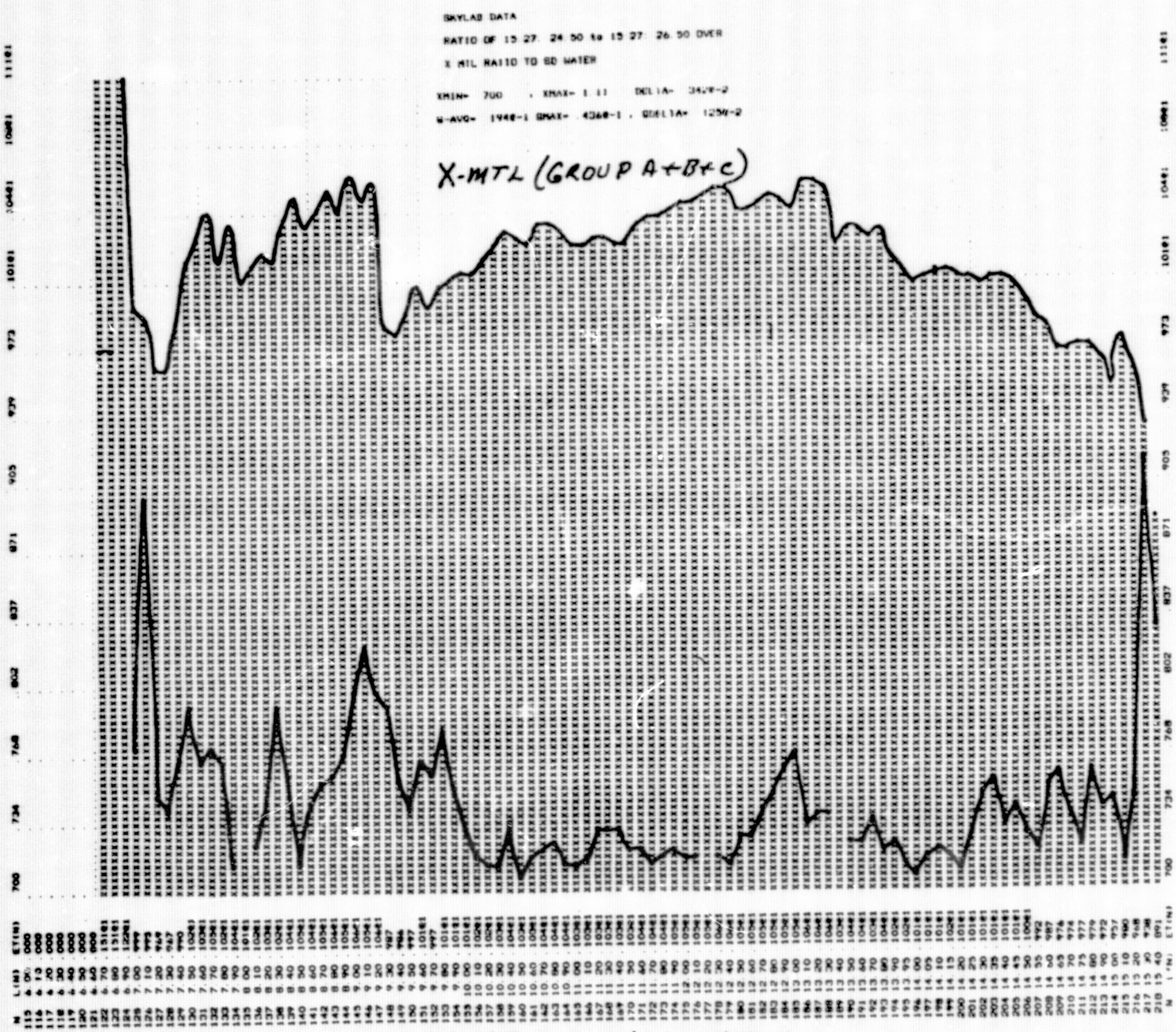


Figure 4.3.3.10 Target ratio to water--
X-material (A+B+C)

4.3.4 Detailed analysis of geological separability - S191

To further explore the capability of the S191 spectra to differentiate terrain materials the geological portion of the record (15:27:15:24 to 15:27:33.90 GMT, SL3, Day 223) was studied in detail, specifically locating the ground track (of the boresight camera crosshairs) onto larger scale aerial photographs. The area involved was Walker Lake (S-end) to Garfield Flat. During this period the astronaut was sweeping the optics forward, to locate and hold onto the playa lake.

Unfortunately, while he was doing this only sporadic spectra were recorded. (At least only a few are now present on the tape). Five seconds of data are missing (GAP) over Hawthorne beach, with only one spectrum available in that time frame. (See Table 4.3.4). Accordingly single spectra were used (without standard deviations being calculated) which tends to produce very noisy spectra. Figure 4.3.1 shows this single emittance spectrum for "Hawthorne Beach" and its difference to "Early Garfield" (see lage). The ratio to standard water (Set E) is shown in Figure 4.3.2.

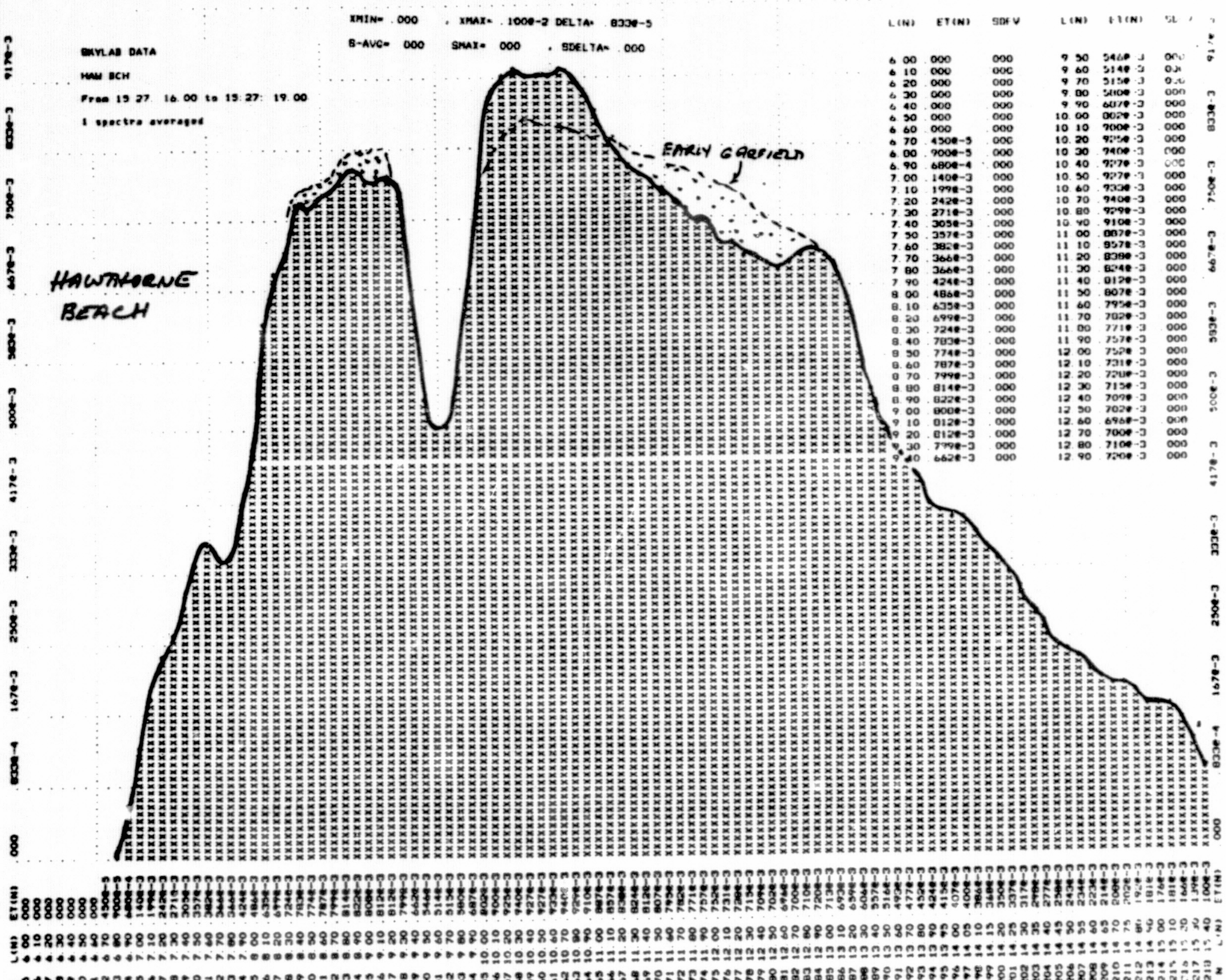
In the time block 15:27:24.50 to 15:27:26.50 (GMT) three spectra occur whose ground track (while the astronaut was sweeping the optics) across the terrain passing (W to E) across Garfield Playa). Too much terrain, of too varied a nature are contained in the other spectra to make any geological correlation meaningful.

These spectra indicate that for three different terrains we have different spectra, although the S/N ratio is too low for more definite identification.

Table 4.3.4

Rock type/spectral correlations Hawthorne Beach-Garfield Flat

Spectrum time	Probable Rock Type covered	RB57 Data Set
15:27:17.93 (N=1)	Hawthorne beach	Site 9
15:27:24.56 (N=1)	X-material "A" (Qtm) + Kgr	Sites 10, 11, + 8
15:27:25.50 (N=1)	X material "B" Qal +Felsic volcs	Site 12
15:27:26.43 (N=1)	X material "C" (Qtm)	Sites 10, 11
15:27:24.56 (N=3) to 15:27:26.43	X-material "A+B+C" (Summed to reduce variance)	



L(N)	ET(N)	SDEV	L(N)	ET(N)	SDEV
6.00	.000	.000	9.50	.5460-3	.000
6.10	.000	.000	9.60	.5140-3	.000
6.20	.000	.000	9.70	.5150-3	.000
6.30	.000	.000	9.80	.5800-3	.000
6.40	.000	.000	9.90	.6070-3	.000
6.50	.000	.000	10.00	.8020-3	.000
6.60	.000	.000	10.10	.9000-3	.000
6.70	.4500-5	.000	10.20	.9250-3	.000
6.80	.9000-5	.000	10.30	.9400-3	.000
6.90	.6800-4	.000	10.40	.9270-3	.000
7.00	.1400-3	.000	10.50	.9270-3	.000
7.10	.1990-3	.000	10.60	.9330-3	.000
7.20	.2420-3	.000	10.70	.9400-3	.000
7.30	.2710-3	.000	10.80	.9290-3	.000
7.40	.3050-3	.000	10.90	.9100-3	.000
7.50	.3570-3	.000	11.00	.8870-3	.000
7.60	.3820-3	.000	11.10	.8570-3	.000
7.70	.3660-3	.000	11.20	.8380-3	.000
7.80	.3660-3	.000	11.30	.8240-3	.000
7.90	.4240-3	.000	11.40	.8120-3	.000
8.00	.4860-3	.000	11.50	.8070-3	.000
8.10	.6350-3	.000	11.60	.7950-3	.000
8.20	.6990-3	.000	11.70	.7820-3	.000
8.30	.7240-3	.000	11.80	.7710-3	.000
8.40	.7830-3	.000	11.90	.7570-3	.000
8.50	.7740-3	.000	12.00	.7520-3	.000
8.60	.7870-3	.000	12.10	.7310-3	.000
8.70	.7990-3	.000	12.20	.7200-3	.000
8.80	.8140-3	.000	12.30	.7150-3	.000
8.90	.8220-3	.000	12.40	.7070-3	.000
9.00	.8000-3	.000	12.50	.7020-3	.000
9.10	.8120-3	.000	12.60	.6960-3	.000
9.20	.8120-3	.000	12.70	.7000-3	.000
9.30	.7990-3	.000	12.80	.7100-3	.000
9.40	.6620-3	.000	12.90	.7200-3	.000

Figure 4.3.4.1 SKYLAB Target emittance- Hawthorne Beach

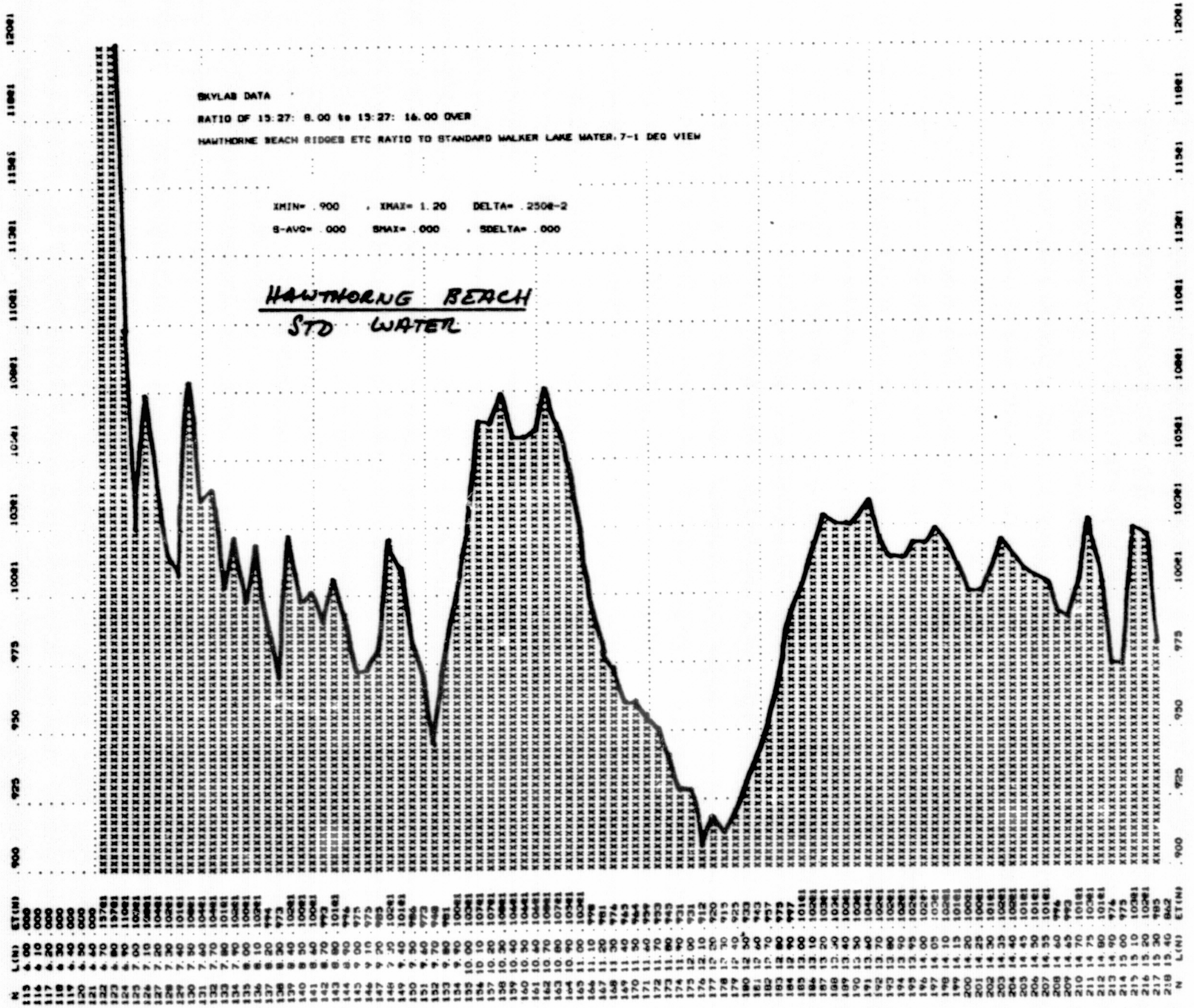


Figure 4.3.4.2 Target ratio to water Hawthorne Beach

TABLE 4.3.4.1 Actual Spectral Times on S-191 Tape SL3, Day 223

Segment from Walker Lake to Garfield Flat

NADIR view

End; Walker Lake	15:27:15:24		— — — — —GAP
	15:27:17.93		— — — — —GAP
	15:27:19.90		
	15:27:20.80		
	15:27:21.80		
	15:27:22.70		
	15:27:23.64		
	15:27:24.56	A	A+B+C
	15:27:25.50	B	
	15:27:26.43	C	
	15:27:27.36		
	15:27:28.23		
	15:27:29.20		
— — — — —	15:27:30.10		— — — — —Locked-on to Garfield Flat
	15:27:31.10		
	15:27:32.00		
	15:27:32.96		
	15:27:33.90		— — — — —last spectrum on tape

X-Material "A": 50% $\frac{\text{Qtm (mafic volcanics)}}{\text{+ shales \& limestones}}$ + Kgr (granite)

X-Material "B": 80% <u>Qal (alluvium)</u> + felsic volcanics

X-Material "C": Qtm (mafic volcanics)

Curve R (Fig. 4.3.3.2) is the emittance trace from the RB57 spectrum over Garfield Flat, scaled to match the S-191 data, and showing a good correspondence and a plausible explanation of the double peaks at 9.2 and 10.0 μm as being inflexion points with a local emission maximum from ozone, not cancelled out by division by spectrum Set E. This increase in ozone radiance cannot be simply explained from the Walker Lake spectra. In the relative scale of Table 4.2 about 25 units of minimum have been lost. This would necessitate an airpath difference of roughly 15° to compensate. Garfield Flat viewing angles only introduce about 6°.

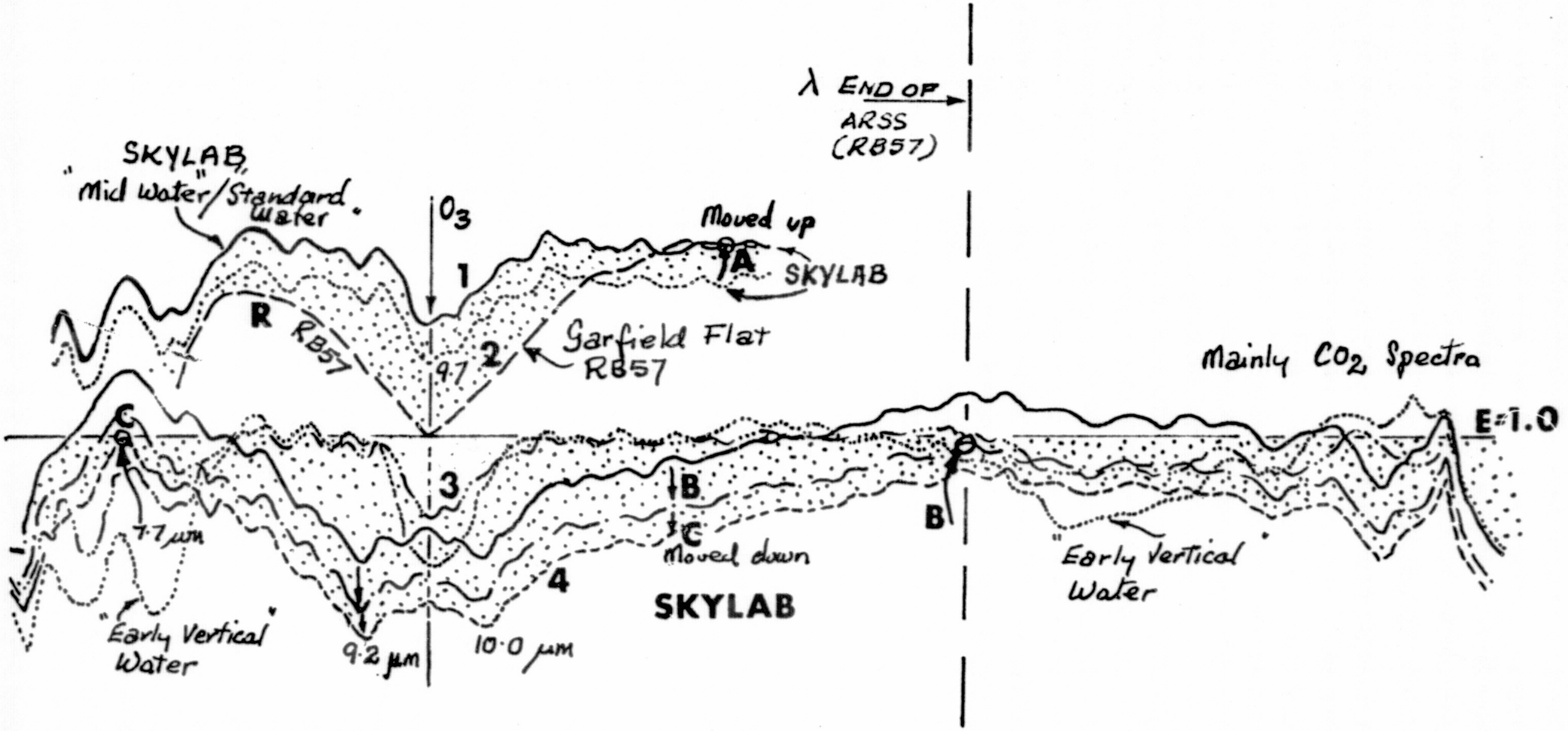


Fig. 4.3.4.3 Spectral emittance curves for SKYLAB and RB57 units compared. Curve(1) = Curve (3), displaced vertically. Spectral emittance difference (Curve 1 - Curve 2) is due to the Garfeeld Flat target. Similarly with (Curve 3 - Curve 4)(or, 1-4), is also due to the target. Spectrum (A) is moved up in emittance, to be coincident with RB57 spectrum (R) at 12.0 um. Spectrum (B) is moved down, to E=1.0 at 13.0um, and Curve (C) moved to E=1.0 at 7.7um, to show spectral <u>differences</u>.

5.0 CONCLUSIONS

5.1 SUMMARY

Use of the S-191 spectrometer system aboard the SKYLAB SL3 mission showed that geologically-meaningful spectra can be extracted from the data by which terrain target can be differentiated. The Si-O bond in all silicates (which form most surface rocks) produced an emission minimum which is characteristic of a mineral, or a set of minerals in a rock. The underflight RB57 mission was far more successful, primarily because of its much slower velocity allowing a higher signal/noise, and hence better spectral resolution for any given area of terrain. With the RB57 spectra not only could areas be differentiated, but significant differences in rock targets could be demonstrated, even to indicating the immediate source (geological provenance) of some alluvial outwash in the nearby mountains over which the aircraft also flew its flight strip.

5.2 DETAILS

5.2.1 Time checks between the airborne data sets of the RB57 underflight and the photographic record could be obtained, if the times-of-crossing of shorelines of water bodies are initially correlated. Similar validation was possible with the SKYLAB data sets, although some confusing boresight photography (at high zoom position) often indicated water on the crosshairs, while the S-191 data temperatures indicated warmer land surfaces.

5.2.2 The RB57 (vertical viewing) spectrometry <u>can be related meaningfully to ground geology</u>, despite the 20 km of air, if care is taken to use large patches of terrain as targets, and to expect some (small) amount of positional error.

The unrequested summing of spectra from the rapid scanning spectrometer (6 scans/sec; 3 up ramp and 3 down ramp, interleaved) to 1 scan/sec up ramp and 1 scan/sec down ramp tripled the ground-smear per spectrum and destroyed some of the spectral subtlety usually in the data sets. In no way was it possible to <u>directly</u> compare S-191 and RB57 data sets, because of their different mission profiles (azimuths, times of overflight, look angles, etc.) thus the commonality of the 1 sec spectrum was of no assistance.

5.2.3 The S-191 was a feasibility test and as such performed well. It is possible to differentiate geological materials from space using the system, but probably not to precisely identify their surface mineralogy. (With the RB57 the rock type mineralogy could be established, albeit in terms broad to a traditional petrographer.)

6.0 RECOMMENDATIONS

6.1 Direct-reading spectra, from S-191 data, serially on a single tape would avoid the time-consuming (and dollar cost) of running two tapes at once, and searching within them for the six sections required to be joined into one spectrum. A more complex format could not be believed.

6.2 In future missions, use of the S-191 concept (near-vertical viewing and pointing) is all that would be necessary. The possible refinement in atmospheric subtraction, using a variable niew approach (-45 deg to near-vertical) does not appear to warrant the allocation of mission time it required. Water observations, as nearly coincident as possible with the terrain observations, are an essential part of the method.

7. REFERENCE MATERIALS

7.1 Acknowledgements. The ground data collection program could not have been carried out over the 6-month SL-2 and SL-3 flight sequence without the great assistance provided by several people: Dr. Andrew Green, post-doctoral associate from CSIRO, Australia, as co-principal investigator helped coordinate SL-2 (Mono Lake) data collection; Jack Quade, University of Nevada, who generally spear-headed the logistical side of data collection and also provided invaluable temperature data from Garfield Flat, during SL-3 (Day 233); Gary Ballew and Bob Campbell collected lake-surface data on SL-3 (Walker Lake) and airborne data over Mono Lake for Day 256.

The unenviable task of reading, unpacking and reformatting the S191 CCT taped date fell initially to Dr. F. R. Honey, a post-doctoral associate, now also of CSIRO, Australia and then to John Prebus of IMSSS, Stanford.

To Saul Levine go my thanks and appreciation for the excellent, careful job of locating the ground location of the spectra, and preparing the emittance spectra and correlative ground locations on the aerial photographs.

Finally, without the astronauts, especially Jack Lousma, we would not have had any S191 data. Particularly I was impressed by the crew of SL-2 who attempted the experiment despite their other troubles associated with the lift off calamity of SL-1. To omit the ground controller of SMO and our PI-coordinators would also be unfair.

To all those men I am expecially thankful.

7.2 REFERENCES

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APPENDIX B

Ground Temperatures--SL3 Overpass

A. Walker Lake; 15:18 to 15:37 (SL3 overpass was 15:26:40)

	GMT	PDT (local)	Temp(°C)	
(1)	15:18	0818	20.4	Close in NW shore (flying 1000 ft; 300 m at 80 Kts)
	15:20	0821	23.5	flying SE at 300 m
	15:21	0821	22.5	following SL 3 track
	15:21:30	0821:30	23.5	
	15:22	0822	23.7	crossing muddy line no Δ T
	15:24	0824	24.4	passed boat landing
	15:25	0825	23.0	wind streaks on lake
	15:25:30	0825:30	22.5	
	15:26	0826	22.5	
	15:26:30	0826:30	22.8	
***	15:26:40	0826:40	--	SKYLAB SL3 overpass
(2)	15:27	0827	22.5	near SE shore
	(1) to (2) mean 23.1 $\pm$ 0.7 (cov .03)			
(3)	15:28	0828	24.0	passing up E shore going N
	15:29	0829	23.0	
	15:30	0830	22.0	crossed brown/blue (degree) line in water, no ΔT
	15:31	0831	22.0	
	15:32	0832	22.5	crossing mid lake, flying W
	15:32:30	0832:30	22.5	
	15:33	0833	22.5	flying S down SL3 track
	15:34	0834	22.0	recrossed muddy line (of 15:22), noΔ T
	15:35	0835	23.0	passed over Ballew's boat (he read PRT4-22.8; thermometer of 23.3 at 15:37)
(4)	15:37	0837	--	crossed SE shore, passing along SL3 track to Garfield Flat
	(3) to (4) mean 22.6 $\pm$ 0.7 (cov .03)			

Total mean 22.9 $\pm$ 0.7 (cov .03)

Best temperature to use 23.0 $\pm$ 0.7°C

B. Garfield Flat; 15:47-15:52 (SL3 overpass was 15:27:30)

GMT	PDT (local)	Temp(°C)	
1. Alluvium S of Hawthorne (S foothills, in ammunition dumps)			
15:40	0840	29.0	
2. Alluvial wash N of Garfield playa			
15:48	0848	27.5	
3. Garfield Flat			
15:47:30	0847:30	24.2	NW edge of playa (over Quade's station)
15:48	0848	24.0	
15:48:30	0848:30	24.5	
15:49	0849	25.0	S end, turning to fly N up W side
15:49:30	0849:30	22.5	
15:50	0850	24.5	
15:51	0851	24.2	N end turning S up middle of playa
15:52	0852	24.5	
Mean of playa 24.2 ± 0.7 (cov .03)			
D. Playa, Equipment Check at 16:30			
16:30	0930	30.5	Stanford PRT5 (airborne unit)
		30.8	U. Nevada PRT4 (ground based at Garfield Flat all during the mission (87.5°F calc to 30.8°C)
E. Walker Lake, 2nd pass; 16:57 to 17:05 GMT			
(1) 16:55	0955	23.7	Lake center
16:56	0956	23.5	
16:57	0957	22.5	flying NW at N end of lake along SL3 track, opposite the boat landing
16:58	0958	22.7	
16:59	0959	23.5	hit near NW shore
17:00	1000	23.5	left SL3 track crossing to NE shore
17:01	1001	23.5	
(2) 17:02	1002	23.5	
(1) to (2) mean 23.2 ± 0.5 (cov .02)			
(3) 17:03	1003	23.0	crossed blue/brown line possibly 0.5ΔT
17:04	1004	22.0	in blue
(4) 17:05	1005	21.5	in blue clear water close in shore, opposite side of lake from wind
(3) to (4) mean 22.2 ± 0.8 (cov .03)			
Total mean 22.9 ± 0.7 (cov .03)			

Best temperature to use = 23.2°C ± 0.5

F. Other localities overflown

GMT	PDT (local)	Temp(°C)	
1. Yerington copper pit, Nevada, 300 m/terrain; PRT5			
14:56	0756	22.2	sagebrush covered outwash E slope of Singatse Ra. 2 km N of Yerington
14:59	0759	21	leach ponds, water
		25	dikes around ponds
		18	marsh tailings in ponds
		23	N dumps at mine (ranged from 21-25 °C with varying sunlight levels)
		17	Walker River at mine
15:03	0803	16-16.5	Alfalfa fields in Mason Valley, near Yerington town
2. Wasuck Range, west of Walker Lake			
15:12	0812	--	slight haze near lake, some light wind from W (downslope onto lake); pilot remarked on absence of turbulence over this range crest

Walker Lake Surface Conditions for SL3 Overpass, Aug. 11, 1973

STN #	GMT time	PDT time	Lake temp (°C) PRT-4	Lake temp (°C) Thermom.	Air temp (°C) Wet B.	Air temp (°C) Dry B.	H_2O in air g/kg of dry air	Rel. Hum. %	wind dir. & vel.	wave height	Dist. from shore on SE line
1	15:05	0805	22.8	23.3	--	22.2	--	--	SE 2.5 KTS	6 cm	20 m = 0.01 NM
2	15:10	0810	23.3	23.9	--	21.6	--	--	SE 2-5 KTS	6 cm	1250 m = 0.67 NM
-	15:26:40	0826:40	-- * * --		SL3 overpass						
3	15:30	0830	23.3	23.6	17.8	21.6	14.8	68	calm	3 cm	2780 m = 1.50 NM
-	15:35	0835 * *	23.0	PRT5 in light aircraft @ 300 m elevn. passed directly over boat							
4	15:37	0837	22.8	23.3	16.7	20.6	13.8	67	calm	3 cm	4500 m = 2.43 NM
5	15:45	0845	23.3	23.9	15.6	21.1	12.8	55	calm	2 cm	8900 m = 4.80 NM
6	15:58	0858	23.9	24.7	20.0	22.2	17.0	82	calm	0 cm	13000 m = 7.01 NM
7	16:05	0905	23.3	23.9	--	--	--	--	calm	2 cm	8900 m = 4.80 NM
8	16:15	0915	23.3	23.9	18.3	23.3	15.3	61	SE 0-2 KTS	2 cm	40 m = 0.02 NM
-	16:30	0930	21.1 ± 0.3 (radiometer) RB57 overflight across lake N = 54, 16:29:20 to 16:30:14 22.4 max at 10.7 m (spectrometer) RB57 south end N = 22; 16:29:40 ± 16:30:00								

Surface mean temperature - radiometer 23.3 ± 0.4, N = 8 (cov .01)
thermometer 23.8 ± 0.5, N = 8 (cov .02)

Table

Airborne PRT-5 Temperature Data Taken Over Mono Lake at 300 m elevn., Day 256, Sept. 13, 1973

	GMT	PDT (local)	Temp(°C) water	Temp(°C) land	Comments
(1)	18:55:00	1155	18		offshore near Black Pt.
	18:56	1156	18		
	18:57	1157	17		proceeding W and SW along shore
	18:58	1158	17		
	18:58:30	1158:30	19		
	18:59	1159	18		
	18:59:30	1159:30	18.5		
	19:00	1200	18.5		opposite Lee Vining
(2)	19:00:30	1200:30	18		near S point
	19:01	1201		39	on S shore
	19:01:30	1201:30	18		
	BOAT**	1202	19		passed over boat heading 19.5 on PRT-4 and thermometer
	19:02:30	1202:30		43	on shore S Beach
	19:03	1203		44	"
	19:03:30	1203:30	19		
	19:04	1204		23	cool moist beach
	19:04:30	1204:30	18.5		
	19:05	1205		26	moist beach S shore
	19:05:30	1205:30		40	0.5 mi inland, SE shore
	19:06	1206	20		
	19:06:30	1206:30	20		
	19:07	1207		29	shore, NE beach
	19:07:30	1207:30		41	0.5 mi inland
	19:08	1208	18		
	19:09	1209	20		
	19:10	1210		26	shore, E of Black Point
	19:11	1211		47	Black Point
	19:12	1212		57	Black Point beach (basalt cinders)
	19:14	1214	18.5		1/2 way to Paoha Is.
(3)	19:14:30	1214:30	18.5		circling Paoha Is., (3) to (4) off Negit
	19:15	1215	19.5		
	19:15:30	1215:30	19		
	19:16	1216	20		off S shore Paoha Is.
	19:17	1217	19		
	19:18	1218	18		
(4)	19:18:30	1218:30	18		near Negit again
(5)	19:19	1219		37	on shore (5) to (6) circling Paoha Is.
	19:20	1220		45	
	19:21	1221		47	
	19:22	1222		40	S shore Paoha Is.
(6)	19:23	1223		35	
	19:23:30	1223:30		30	Negit Is. (black)

	GMT	PDT (local)	Temp(°C) water	Temp(°C) land	Comments
(7)	19:33	1233		39	WSW to ENE flight parallel to Track 29
	19:33:30	1233:30	18		Lee Vining-Paoha Is.
	19:34	1234	18.5		to NE shore
	19:34:30	1234:30		40	W shore Paoha Is.
	19:35	1235		44	Paoha Is.
	19:35:30	1235:30		37	E shore Paoha Is.
	19:36	1236	19		
	19:36:30	1236:30	19.5		
	19:37	1237	19.5		
	19:37:30	1237:30	19.5		
	19:38	1238	19		
	19:38:30	1238:30		27	Beach Ne shore lake
	19:39	1239		44	on shore
	19:40	1240		45	
	19:40:30	1240:30		44	
(8)	19:41	1241		44	end traverse along Track 29
(9)	19:46	1246		54	Traverse N to S
	19:46:30	1246:30		44	Across lake center to E of Paoha Is.
	19:47	1247	20		
	19:47:30	1247:30	19.5		
	19:48	1248	20		Crossing Track 29
	19:49	1249	20		
	19:49:30	1249:30	19.5		
	19:50	1250		45	S shore
(10)	19:50:30	1250:30		41	inland 1 mile
(11)	19:55	1255		43	Traverse S to N
	19:55:30	1255:30		42	Along Crater to S shore of lake thence
	19:55:45	1255:45		47	to Black Point W of Paoha Is.
	19:56:20	1256:20		39	"
	19:56:30	1256:30		35	"
	19:56:45	1256:45		35	"
	19:57:10	1257:10		31	
	19:57:20	1257:20		30	
	19:57:35	1257:35		37	
	19:57:45	1257:45		40	Crossing S shore
	19:57:55	1257:55	15		offshore
	19:57:58	1257:58	20		
	19:58	1258	19		
	19:58:30	1258:30	19		
	19:59	1259		65	Black Point beach
	19:59:30	1259:30		45	Black Point hill
(12)	20:00	1300		45	End of Mono data

Table

Boat Temperatures, Mono Lake, Day 256, Sept. 13, 1973

	GMT	PDT (local)	Temp(°C)* water	Distance from S shore
1	18:40	1140	19.5	0.2 mi
2	18:55	1155	19.5	0.5 mi
3	19:05	1205	19.5	0.6 mi
4	19:20	1220	19.5	0.7 mi
5	19:40	1240	20.0	1.0 mi
6	19:47	1247	19.6	1.2 mi
7	20:16	1316	19.5	0.3 mi

*PRT-4 radiation termometer

Table

Airborne PRT-5 Temperatures on SSE to NNW flight up Soda Spring Valley past Mina, Borax and Luning, Nevada, 300 m altitude, Day 256, SL3

GMT	PDT (local)	Temp(°C)	Comments
20:30	1330	46	
20:30:30	1330:30	44	
20:31	1331	45	opposite Borax
20:31:20	1331:20	43	
20:31:30	1331:30	44	opposite Luning
20:32	1332	42.5	

Table

A. Spectral Resolution S191

λ range	Δλ
6.0-16.0 μm	0.019*

B. In-band Transmission (τ on)

region	λ (μm)	τ on
6.0 to 9.2 μm	5.8	0.62
	6.5	.62
	7.5	.60
	8.5	.54
	9.5	.53
9.3 to 15.4 μm	9.2	.67
	10.7	.66
	12.3	.52
	13.7	.51
	14.9	.38
	15.4	.20

(Source, Table II, S191, Cautionary Notes for data processed according to PHO TR 524 CH 2, July 3, 1974, T. Barnett.)